Capt. [illegible] to [illegible]

An Universal Military Dictionary,

Or,

A Copious Explanation of the Technical Terms &c

Used in the Equipment, Machinery, Movements, and Military Operations of an Army.

By

Capt. GEORGE SMITH,

Inspector of the Royal Military Academy at Woolwich.

P. Sandby delin. C. Grignion sculp.

London

Printed for J. MILLAN, near Whitehall; 1779.

TO THE

KING.

SIRE,

NOTHING can juſtify my preſumption in approaching your Royal Perſon with this Work, but the conſideration, that it is not foreign to the ſtation in which your Majeſty has vouchſafed to place me, and that it treats of an Art which conſtitutes one of your favorite amuſements.

Animated

Animated with the deſire of promoting, within my own ſphere, the intereſt and welfare of my Country, I have been emboldened to engage in the undertaking: And, perſuaded that your permiſſion to addreſs my Work to your Majeſty cannot fail to ſuggeſt to every Student in the Military Art, that ſuch a performance is eſſential to the attainment of that Art, I have cheriſhed the ambition of laying it at your Royal feet; hoping, that under the gracious favor and protection which your Majeſty deigns to extend to the well-meant endeavours of your Subjects, it will be conducive to the end for which it was undertaken.

That your Majeſty may long reign in the hearts of a brave, free, united, and happy People, is the ardent wiſh of

Your Majesty's

Moſt dutiful and moſt faithful

Subject and Servant,

George Smith.

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PREFACE.

IT being the general opinion, that the dignity of ſciences is more or leſs in proportion to their uſefulneſs, how apparently then does the Art of War claim the firſt place! War (as ſome ſay) is a great evil; but it is inevitable, and oftentimes neceſſary. If he who firſt reduced to rules the art of deſtroying his fellow-creatures, had no other end in view but to gratify the paſſions of Princes, he was a monſter, whom it would have been happy to have ſmothered at his birth! but if his intention was the defence of perſecuted Virtue, or the puniſhment of ſucceſsful wickedneſs, to curb Ambition, or to oppoſe the unjuſt claims of ſuperior Power, his memory ſhould be revered by mankind.

War, in the laſt caſe, is the moſt neceſſary and uſeful of all the ſciences. The various kinds of knowledge, which ſhould furniſh the mind of a Soldier, are not without great difficulty attained. Of moſt other ſciences the principles are fixed; or, at leaſt, they may be aſcertained by the aſſiſtance of experience: there needs nothing but diligence to learn them, or a particular turn of mind to practiſe them. Philoſophy, Mathematics, Architecture, and many others, are all founded upon invariable combinations. Every man, even of a narrow underſtanding, may remember rules, apply them properly, and ſometimes draw juſt conſequences from them: but the ſtudy of War is of another kind.

Experience can be ſo ſeldom referred to rules, that nothing but a mind enlightened by diligent ſtudy can make a due application of thoſe rules to circumſtances.

Moſt artiſts may join practice to theory, and make one perfect by the help of the other. The military man has not always the like aſſiſtance: he ſpends part of his life in forming plans, which humanity forbids his putting in execution; and when he has an opportunity of judging from experience of the ſolidity of his principles, the operations are ſo rapid, the motions ſo diverſified, the actions ſo confuſed, that he has ſcarcely time for a glimpſe of thoſe things which require the moſt calm and cloſe conſideration.

Of learning of every kind, theory is the completion; in the ſtudy of the military ſcience, it is only the introduction. Many an Officer, depending on his rules, has found that the marches, the camps, the diſpoſitions, the manœuvres, performed with exactneſs and ſtrict order in the cloſet, have not only been very difficult, but even impracticable, in the field. A diſpoſition good in a mountainous country, would be bad in an open one; a diſpoſition proper for one open country may fail in another, for want of its being foreſeen that a manœuvre, which in one caſe may have been the cauſe of obtaining a victory, may in another occaſion its loſs: the circumſtances of time and place almoſt always throw the beſt-conſtructed ſyſtems out of order. It is therefore only by ſtudy, and by the contemplation of caſes inceſſantly varied, that the want of practice can be ſupplied, or action at leaſt made leſs difficult.

A military man, who wiſhes to be maſter of his profeſſion, has no hours to loſe: in peace he ſhould ſtudy with the greateſt diligence; in war he will ſee his principles

open

open themſelves of their own accord: his ideas are then more diſtinct; he acts with clearneſs and certainty in all caſes he has foreſeen, and applies his rules to all thoſe which now occur for the firſt time, and which 'till then had eſcaped his attention. Who does not know that bravery, courage, and comprehenſion, are uſeleſs and fatal to a military man who wants knowledge of his buſineſs? Having no previous aſſiſtance from ſtudy, it often happens, that the braver he is, the more he is liable to miſtakes, and the leſs able to foreſee or avoid them.

The ſcience of War branches out into ſo many particulars, it takes in ſo many different parts, there are ſo many reflections neceſſary to be made, ſo many circumſtances and caſes to be brought together, that it is only by a continual application, grounded upon the love of his duty, and an inclination to his profeſſion, that any man can attain it.

To march an army in every ſort of country, whether open, woody, or mountainous; to know how to form a camp in all theſe countries, with which the General muſt be thoroughly acquainted, in order to do it ſecurely; to make a proper diſpoſition for a battle, whether with a view to the poſture of the enemy, or to the ſituation of the country; to foreſee events which depend, in a manner, upon chance; to direct the foragers without fatiguing, or expoſing the troops; to ſend out detachments with precaution; to conduct the convoys with ſafety; to know how to canton an army, and to ſettle it in winter quarters, in ſuch a manner, that by the juſt diſpoſition of all the parts, it may be able to aſſemble readily on the firſt order, though widely diſperſed; to eſtabliſh magazines in places both ſafe and within reach of the army, ſo that it ſhall never be in want of ſubſiſtence: theſe are the great ends of the military ſcience. Alexander, Guſtavus, Weimar, Condé, Turenne, Montecuculi, Vendoſme, Marlborough, Eugene, Schwerin, Wolfe, and all the great men that have gone before, would never have been the ſubject of our admiration, if they had neglected this ſtudy in any of its branches. It is by courage, genius, and capacity; by having a head always cool, and an eye at once quick and exact; by a nice knowledge of the country, by ſkill in the choice of officers, and by ſtrict diſcipline kept up in his army, that a General is enabled to take ſuch juſt meaſures as will fruſtrate the deſigns of the enemy.

It is commonly thought ſufficient for a military man to know how to obey; and it is alſo ſuppoſed that the ſucceſs of a day cannot be dubious, if a General joins the confidence of the Soldiers to all the foregoing qualities.

It is true, that in caſes of perplexity, many Generals have in a great meaſure owed to their own capacity, and the confidence their Soldiers have repoſed in them, the advantage they have gained over the enemy. But is the Officer who loves his duty, and who would make himſelf maſter of it, under the leſs obligation to know what qualifications his ſtation requires? that he ſhould have ſuch or ſuch a quality, in ſuch or ſuch a circumſtance? that here only bravery is neceſſary, there only courage? and that he is not always obliged to have both at the ſame time?

Theſe two virtues, which are often confounded in the ſame ſubject, merit a particular diſtinction: they are not ſo cloſely united, but that they are often to be found one without the other. Courage ſeems fitteſt for a General, and all thoſe who command; bravery more neceſſary for a Soldier, and all who receive orders: bravery is in the blood, courage in the ſoul; the firſt is a kind of inſtinct, the ſecond a virtue; the one is an impulſe almoſt mechanical, the other a noble and ſublime conception. A man is brave at a particular time, and according to circumſtances; he has courage at all times, and upon all occaſions. Bravery is ſo much the more impetuous as it is leſs the reſult of reflection; courage, the more it is the effect of reaſon, becomes more intrepid. Bravery is inſpired by the force of example, inſenſible of danger, and the fury

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of action; courage is infused by the love of our duty, the desire of glory, and zeal for our king and country: courage depends on reason; but bravery, on the constitution. Achilles, such as Horace describes him from Homer, implacable, cruel, despising every other right but that of force, presents nothing to the idea, but the hardiness of a gladiator: but the Roman General, whose death would have produced the ruin of the army, the great Scipio, when covered by the bucklers of three soldiers, to avoid a shower of arrows which the enemy directed against him, approaches in safety the walls he besieged, and standing only a spectator of the action, and content himself with giving them orders, exhibits the idea of true courage. Bravery is involuntary, and depends not at all upon ourselves; whereas courage (as Seneca observes) may be taught and acquired by education: but yet, nature must sow the first seeds of it. It would be easy to make the difference of these qualities better understood, by running over all the cases in which they make their appearance, were it not for the fear of going too far in so copious a subject. It is said of a magistrate, who exposes his life and fortune in defence of the laws, that he has virtue. Cicero, sheltering himself from the hatred of Catiline, undoubtedly wanted bravery; but certainly he had an elevated firmness of mind (which is in reality courage), when he disclosed the conspiracy of that traitor to the Senate, and pointed out all his accomplices; or when he pleaded for Deiotarus against Cæsar, his friend and his judge.

Coolness is the effect of courage, which knows its danger, but makes no other use of that knowledge, than to give directions with greater certainty: courage is always master of itself, provided against all accidents, and regulated by the present occasions; never confounded by any danger, so as to lose sight of the motions of the enemy, or of the means by which he may be most effectually opposed. At the battle of Cannæ, when Gisco seemed to be most astonished at the superiority of the enemy's number, Hannibal answered him coolly, "There is a thing still more surprising, of which you seem to take no notice." Gisco asked him what it was: "It is, replied Hannibal, that in all that great croud, there is not one man whose name is Gisco." Plutarch observes, that this coolness of Hannibal greatly animated the Carthaginians, who could not imagine that their General would joke at so important a time, without being certain of overcoming his enemies.

Although bravery and courage are the most essential qualifications of a subordinate officer, yet he should not be deficient in those which are required in a General, and which have been already mentioned: obedience to the orders delivered to him, is no longer a virtue than whilst he comprehends and knows the intention of them. War, says a celebrated author, is a business which like all others must be learned; it supposes some qualities to be born with us, and demands others which are to be acquired: but since all these qualities must have their original source in genius, a man who proposes war for his profession, should never engage in it without having consulted his natural bent, or without knowing the particular turn or power of his mind. Ability, whether in a General, or inferior officer, is the effect of his genius, quickened by a natural liking to his business. Without this liking, without this sort of call, which as it were draws us on against our wills, and which is the sure sign of a particular determination of the mind, a man studies without effect, and practises without judgement.

Genius is not to be acquired; it is born with us. It has been defined to be a natural aptitude of doing something: but that definition is wrong; it is the disposition only that should be so defined. It is said to be easier for nature to produce a monster, than a man without a particular disposition: but every one is not born with a genius; it is the fairest attribute of the soul. With parts a man may be a good soldier; but with genius a good soldier becomes a great general. It is sometimes an assemblage of talents,

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but is always the perfection of that which nature has given us, that discovers genius. A man studies; he searches for his talent, and often misses it; genius unfolds it. Talent remains hidden for want of occasions to show itself; Genius breaks through all obstacles: Genius alone is the contriver; Talent, only the workman.

It often happens, that he who has only bright parts, is believed to have genius. These two modifications of the soul are very different. Genius can only apply itself to the sciences and noble arts; Wit, more airy, skims indifferently over all: the former undertakes but one science, but goes to the bottom of it; the other would undertake every thing, but touches only lightly upon all: Wit renders the talents more brilliant, without their becoming more solid; Genius, with less application, conceives every thing, outstrips even study itself, and brings the talents to perfection.

There are many amongst us who become soldiers, only because their ancestors were so: they undoubtedly have bravery; that virtue is not scarce among the English; but there are many others which should accompany it. The virtues of our ancestors should stimulate our minds, and engage us to follow their steps; but their blood, transmitted to us, does not always convey that sagacity, that intelligence, that particular inc ination for our business (the true mark of genius) in a word, those talents of which we must carry the seed within us.

But some are by birth engaged in the profession of arms, before time has permitted them to consult their genius and their powers. Are these men to quit, if they perceive that they are not endowed with every talent that profession requires? Undoubtedly no; because they may acquire them. Study and application will in a great measure supply the defects of genius; docility may serve instead of talents; the love of glory be equivalent to a liking for their business; and the virtues of their fathers should always be present to their thoughts. When a man has no ancestors to imitate, he is (if I may use the expression) at liberty to raise a reputation of more or less lustre: by being descended from celebrated ancestors, he is obliged to follow their example, and may often improve upon their virtues. Claudius reproached Cicero with being the first of his race. 'But you,' answered Cicero, 'are the last of yours.' An illustrious descent is oftentimes a burthen: if it adds splendor to the man of virtue, it always disgraces him who knows not how to support it.

A quick eye is natural in some, and in them it is the effect of genius; others acquire it by study or experience. He who knows how to command himself, and has courage enough to keep himself cool on the most urgent occasions, has the readiest and quickest eye. A quick, hot-headed man, however brave, sees nothing; or, if he does, it is confusedly, and generally too late. It is this quick eye which enables him to judge of an advantageous post, of a manœuvre to be made, and of a good disposition for the troops, whether with respect to that of the enemy, or to the situation or nature of the country. There is a quickness of eye which depends upon the enemy, and another independent of him. It depends upon the enemy when he has made such a disposition, that to attack him another must be made upon the spot, which renders his defective and weak in some part; or when, being advantageously posted, the General obliges him to change his position, by making him fearful of being taken in flank, or of being surrounded; or when it is so contrived as to render the troops on the right useless, by attacking the left, without their being able to assist it.

It is independent of the enemy, when a commander, being at a distance, knows how to take an advantageous position, and how to chuse a camp strong by situation; when he sees at once what distances there are upon the right and left of the troops, that may prevent either their being molested or surrounded, and observes the posts necessary to be occupied for their safety; when he marches with a detachment, and diligently surveys

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the ground by which he may retreat, if he ſhould be attacked and repulſed by ſuperior forces, taking care that he may not be ſurrounded, and that the enemy may not be able to oppoſe to him a front more extenſive than his own.

The quick eye is no other than that penetrating genius, which lets nothing eſcape it; that looks into the heart, and diſcovers the lighteſt impreſſions which can diſorder it. A General who knows how to unite this quality with perpetual coolneſs, never is in want of expedients; he will ſee how theſe events, which to any other would be the preſage of his own defeat, may end in the overthrow of his enemies.

The army of Cyrus, in the preſence of that of Crœſus, at Timbrea, took a clap of thunder for a bad omen. This impreſſion did not eſcape the quick eye of Cyrus; but the coolneſs which on this occaſion he knew how to preſerve, ſuggeſted to him an interpretation which removed his ſoldiers fears. "My friends, cried he, Heaven declares for us: come on! I hear the ſound of victory. Great Jupiter, we follow thee!"

The choice of the general officers depends upon this genius, which diſcovers every thing: they ſhould be the right-hand of the General in Chief, and as capable of commanding the army as himſelf.

Whatever good diſpoſitions a General may make, they muſt prove ineffectual, if not ſeconded by the general officers under his command; he cannot be every where, neither can he foreſee all exigencies that may ariſe. He is obliged to give only general orders: it is therefore the buſineſs of thoſe who command under him, to know how to take the advantage of a wrong movement of the enemy; to take upon them to attack or ſuſtain the troops which are engaged, and, as circumſtances vary, to make them advance towards the enemy, either to keep him back, or to attack him. But ſtill we muſt except the reſerve, which ſhould never march without an order from the Commander in Chief.

But the qualities already mentioned would be uſeleſs, if order and diſcipline were not ſeverely obſerved: the moſt numerous and beſt compoſed army would ſoon become little elſe than a body of rangers, who, being only united by the hope of booty, would ſeparate as ſoon as that motive ceaſed, and truſting each to his own head, or indulging his own humour, would be cut in pieces party after party: ſo that, if the General does not keep up ſubordination (the ſoul and ſtrength of diſcipline) his army will be nothing more than a troop of Tartars, acting more from the hope of plunder, than the deſire of glory. What art, and what genius, is there not requiſite to maintain this ſubordination! Too much ſeverity diſguſts the ſoldier and renders him mutinous, diſcourages him, and makes him deſert; too much indulgence ſinks him into indolence, and makes him neglect his duty: licentiouſneſs cauſes that ſubordination to ſeem burthenſome, which ſhould never in any degree be given up: he loſes that reſpect, and often that confidence, which he ſhould have towards his officers; and indulgence often makes a well-diſciplined body become a ſet of ſluggards, who march againſt their will, and who, on the moſt preſſing emergences, think only on their own ſafety.

The Romans have left us examples both of indulgence and ſeverity: no people ever took more properly the opportunities of puniſhing or forgiving. Manlius cauſed his ſon to be puniſhed with death, for a diſobedience which at any other time would have merited the honours of a triumph. Varro was applauded for an imprudence, which at another juncture would have cauſed his death. In the time of the republic, it was neceſſary to be ſevere, becauſe, as every Roman could aſpire to the ſame rank, it would have been dangerous that ſmall crimes againſt the community had remained unpuniſhed; ſuch impunity would have countenanced enterpriſes which might have deſtroyed the whole ſyſtem of their political government.

The ability, foreſight, and prudence of a General, gain him the entire confidence of both officer and ſoldier. The ſoldier indeed judges but by inſtinct, and is determined only

only by the event; but his judgement is not less infallible: that of an officer is equally just; but he is determined only by full conviction; he puts event out of the question, and places his confidence in nothing but courage and prudence. Confidence is, again, to be acquired by affability to those who are subordinate to us, and by supplying their wants before they are complained of: these two motives for confidence afford a plentiful and certain harvest of laurels to the General. The present King of Prussia, Marshal Luxembourg, Marshal Turenne, Prince Eugene, the Duke of Marlborough, Marshal Saxe, General Wolfe, and many others, have owed the advantages they gained of their enemies, to the confidence of the soldiers; who, loving their General, considered it as their duty to please him, and had no joy in victory, but as they shared it with him.

Besides these qualities, which are essential to a General, and which all who would attain that high rank should of course have, there are still many others necessary to make a Great Man. A Hero requires fewer virtues: the Great Man is always a good member of the community; he considers humanity as his first duty; he is just, open, and unbiassed; his temper may be fiery, but this ardour is always regulated by prudence; he gives advice with the same openness as he would ask it; and never asks but of those whose experience, which he estimates rather by their actions than their age, makes them capable of giving such as may be trusted; he is haughty only to his enemies, free to his equals, affable to his inferiors, brave without either arrogance or rashness, and easy of access to all.

The General should be acquainted with the interests and force of Princes (a knowledge very necessary in judging of the power of Princes upon whom war is made, that he may fall sooner upon the country of him who can obstruct his projects, than upon a Prince who, by the situation of his dominions and force, can make no opposition). In a word, a General who would merit the title of a Great Man, should unite in himself all civil, military, and political excellence. It is by this, that he will easily attain to make war with success: nothing will escape him: he will know, without difficulty, the genius of every country, and of the nations which compose the enemy's army; the abilities of the Generals who command, and the nature of the troops under them. Without these precautions he would never think that he could act upon certain grounds: he knows he may venture a motion with some troops, which he would not dare to attempt with others that are equally brave. One nation is vehement, fiery, and formidable, in the first onset; another is not so hasty, but of more perseverance: with the former, a single instant determines success; with the latter, the action is not so rapid, but the event is less doubtful.

No man is born a General, though he brings into the world with him the seed of those virtues which make a Great Man. Cæsar, Spinola, Turenne, the great Condé, Eugene, Marlborough, Wolfe, and some others, showed, even in their earliest years, such qualities as ranked them above other men: they carried with them the principles of those great virtues which they drew forth to action by profound study, and which they brought to perfection by the help of practice: those who came after them, with perhaps fewer natural talents, have by study rendered themselves worthy of being compared to them. Cæsar and all conquerors had this advantage, that they were able to make their own opportunities, and always acted by their own choice. A man may be a good General without being a Turenne: such geniuses are scarcely seen once in an age; but the more they are raised above the rest of mankind, the more they should excite emulation. It is by endeavouring to surpass the intellects of the second rate,—it is by striving to surpass, or at least to equal the most sublime, that the imitation of them is to be attained. This passion in a soldier is neither pride, nor presumption; it is

virtue,

virtue; and it is by this only, that he can hope to be ſerviceable to the State, and add to the glory of his King.

How much ſoever the honour of commanding armies may be ſought after, it degrades him who is not worthy of it: this rank, ſo much deſired, borders on the two extremes of glory and ignominy. A military man, who labours to make himſelf capable of commanding, is not to be blamed; his ambition is noble: by ſtudying the art of commanding, he learns that of obeying, and of executing.

I ſhould be aſtoniſhed in the higheſt degree, if I ſaw ſoldiers thinking only on preferment, and neglecting the ſtudy of their buſineſs; I ſhould perhaps wonder leſs if I ſaw others, without having been tried, propoſing to themſelves to command in chief; becauſe ſuch attempts ſuppoſe in the projector an abſurd temerity, founded on a profound ignorance of the talents he ſhould have, and the virtues which he has not. Such boldneſs is the character of a man whoſe mind is too narrow to perceive his danger. I ſhould rather approve the timidity that ſuffers itſelf to be dejected by terror, ſince it ſhows, at leaſt, that he knows to what hazards he is expoſed. Both are blameable. Modeſty is the only proper quality of a ſoldier; it gives ſplendor to virtue; it argues diffidence of himſelf, and a deſire of arriving at perfection.

Mardonius, Xerxes's General, propoſed himſelf to the King to command his armies: this conceit of his own talents ſhould have been anſwered by a refuſal: the innumerable troops which he led were defeated by a ſmall number of Greeks, and his preſumption ſerved but to increaſe the misfortune of his Prince. Cincinnatus, endowed with every quality, both of a great man and a great ſoldier, was holding his plough when the Romans came to intruſt the fate of the republic to him: he ſet out, and Rome was delivered from her enemies.

The title of General would be leſs tempting, if proper attention was paid to the qualities it requires, and the duties it impoſes: it would then appear a very honourable, it painful burthen. The moſt firm and intrepid genius might be diſcouraged, merely thinking that on the conduct of a General depends the fate of his country, the of his Prince's arms, and his own reputation.

yet the reward that follows ſuch irkſome labours ſhould animate men to under- hem. Obſtacles, however numerous they may be, are not inſurmountable, ſince ly great men have got the better of them: difficulties ſhould ſtir up a ſoldier's ulation, but ſhould never terrify him; he ſhould endeavour to copy ſuch great originals, though he may not be able to equal them.

This work has engaged my utmoſt application for ſome years. Several performances on the ſame ſubject have already appeared in different languages, but none in our own, except Watſon's *Military Dictionary*, and a *New Military Dictionary*; *or The Field of War, by a Military Gentleman.* Far from exhibiting an enlarged and comprehenſive view of military affairs, theſe productions are extremely imperfect, according to the very circumſcribed plan which their authors have adopted; the firſt being only a ſmall duodecimo pamphlet, and the latter containing an account of the moſt remarkable battles, ſieges, bombardments, and expeditions, whether by ſea or land; ſuch as relate to Great-Britain and her dependencies, deduced from the deſcent of Julius Cæſar to the year 1760, in alphabetical order. Theſe, together with our beſt dictionaries of arts and ſciences, are ſo very imperfect and obſolete in the different terms and machinery of war, as not only to be very vague and perplexed, but even unintelligible. With regard to its internal government in action, to the general regulations of the line of battle, of marches, retreats, encampments, ſieges, mining, artillery, and to the principal movements in manœuvring and tactics, they are almoſt totally ſilent. Had any of theſe works been executed with tolerable ſucceſs, our various military authors would

would not have been under the neceſſity of adding a vocabulary to the end of their works, to explain the military terms they made uſe of.

The ſtudy of the Art of War is generally allowed to be the moſt difficult of any; yet I am of opinion, that this art, like all others, is founded on certain and fixed principles, which are by their nature invariable: the application of them only can be varied; but they are in themſelves conſtant. This moſt difficult ſcience may, I think, be divided into two parts. The one is mechanical, and may be taught by precepts: the other has no name, nor can it be defined or taught: however, it conſiſts in a juſt application of the principles and precepts of war, in all the numberleſs circumſtances and ſituations which occur: no rule, no ſtudy or application, however aſſiduous; no experience, however long, can teach this part: it is the effect of genius alone. As to the firſt, it may be reduced to mathematical principles; its object is, to prepare the materials which form an army, for all the different operations which may occur: genius muſt apply them according to the ground, numbers, ſpecies, and quality of the troops, which admit of almoſt infinite combinations.

But, as this laborious taſk requires too much time to be attempted by the far greater part of thoſe who are deſirous of being thoroughly acquainted with the military arts and ſciences, in their preſent ſtate of improvement and perfection; this Dictionary is offered to the Public as a great help to that branch of knowledge: and I hope that the great pains I have taken, and the many years I have ſpent, in compoſing and perfecting this work, will render it an acceptable acquiſition to my Country.

Animated with a ſincere deſire of making myſelf uſeful to the Public, I undertook this laborious taſk, and have exerted all my abilities to remove every difficulty, and ſmooth the path that leads to the temple of military ſciences.

In order to effectuate this, I have been particularly careful to explain, in the moſt conſpicuous and intelligible manner, the principles upon which every branch of the art of war is founded; and from theſe general principles, I have deduced and eluci the various terms in martial diſcipline, fortification, gunnery, mining, and ſieges; ticularly thoſe now actually practiſed by the moſt famous belligerant powers in Eu

How far this work may prove advantageous, muſt be left to time and experien only hope, that an undertaking ſo evidently calculated to promote the milita cannot fail of meeting with encouragement, in an age when heroic proweſs to the ſummit of perfection.

Royal Military Academy,
Woolwich, Nov. 25, 1778.

GEORGE SMITH.

Principal

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ERRATA.

ARTILLERY-*Park*, line 10, for *incampment*, read *encampment*.
Incampment of a regiment of ARTILLERY, read *Encampment*.
ASSEMBLEE, read ASSEMBLY.
BATTERING-*Train*, line 5, for *the* 10 *and* 8-*inch*, read *the* 13, 10, *and* 8-*inch*.
Shoulder-BELTS, line 2, for, *and to which the pouch fixed*, read *and to which the pouch* is *fixed*.
BOYAU, line 5, for, *that it may be enfiladed*, read *that it may* not *be enfiladed*.
BULLETS, table thereof, last figure in the head column, which stands 6, read 9.
Ancient and present names of Cannon, at the paragraph, *ship-guns*, for 42, 36, 32, read 42, 32, &c.
CANTONMENTS, line 3, for *incampment*, read *encampment*.
COURT-*Martial*, line 2, for *offiences*, read *offences*.
COMPLEMENT, read COMPLIMENT.
DAGGER, line 3. for, *it is not long that since*, read, *it is not long since that*, &c.
How to find the DIAMETER, line 26, for $0586971\frac{1}{8}$, read, $0586971\frac{3}{8}$.
FORGE. *Dimensions of a travelling*-FORGE, for *fore-wheels height* 104, read 64; for *hind wheels height* 64, read 104.
Dimensions of tin TUBES, &c. first column, for $5\frac{4}{5}$ *royal coborn*, dele *coborn*; also, for $4\frac{2}{5}$ *royal coborn*, dele *royal*.
WHEEL, art. 11, line 10, for $\frac{F}{w}$, read $\frac{F}{W}$, &c. Art. 14, line 6, for *to the R*, read *to R*.

SUPPLEMENT.

CAMP, at the paragraph, *Distribution of the front and depth of the* CAMP, *for a battalion of infantry*, line 11, for, *the depth* 759 *feet, formerly* 960, dele the whole.
LABORATORY, in the *table of fuzes*, at the 9th column, top line, for 35 *to* 3, read 35 *to* 38.
LABORATORY, *table of shells ranges*, &c. at *Example* 2, line 10, for $\sqrt{2216}$, read $\sqrt{2316}$.

MILITARY DICTIONARY.

ABBATIS, in a military ſenſe, is formed by cutting down many entire trees, the branches of which are turned towards the enemy, and as much as poſſible entangled one into another. They are made either before redoubts, or other works, to render the attacks difficult, or ſometimes along the ſkirt of a wood, to prevent the enemy from getting poſſeſſion of it. In this caſe the trunks ſerve as a breaſt-work, behind which the troops are poſted, and for that reaſon ſhould be diſpoſed, ſo as that the parts may, if poſſible, flank each other.

ABSOLUTE *Gravity*, in philoſophy, is the whole force by which a body, ſhell, or ſhot, is impelled towards the center. See GRAVITY.

ABSOLUTE *Number*, in Algebra, is the known quantity which poſſeſſes entirely one ſide of the equation. Thus, in the equation, $xx + 10x = 64$, the number 64, poſſeſſing entirely one ſide of the equation, is called the *abſolute number*, and is equal to the ſquare of the unknown root x, added to $10x$, or to 10 times x.

ACADEMY, in antiquity, the name of a villa ſituated about a mile from the city of Athens, where Plato and his followers aſſembled for converſing on philoſophical ſubjects; and hence they acquired the name of Academics.

Military ACADEMY. We have in England two royal military academies, one at Woolwich, and one at Portſmouth. The firſt was eſtabliſhed by his late Majeſty king George II. by warrants bearing date the 30th day of April, and the 18th day of November, 1741, endowed, and ſupported, for the inſtructing of the people belonging to the military branch of ordnance, in the ſeveral parts of mathematics neceſſary to qualify them for the ſervice of the artillery, and the buſineſs of engineers. The lectures of the maſters in theory were then duly attended by the practitioner-engineers, officers, ſerjeants, corporals, private men, and cadets. At preſent the gentlemen educated at this academy are the ſons of the nobility and military officers. They are called gentlemen-cadets, and are not admitted under 13 years of age. They are taught writing, arithmetic, algebra, Latin, French, mathematics, mechanics, ſurveying, levelling, and fortification, together with the attack and defence; gunnery, mining, laboratory-works, geography, perſpective, fencing, dancing, &c. The maſter-general of the ordnance is always captain of the company of gentlemen-cadets, and ſome officer of merit is always captain-lieutenant. There is, beſides, a firſt lieutenant, and two ſecond lieutenants. They are further under the immediate care of a lieutenant-governor, and an inſpector, who are officers of great abilities and experience; and the profeſſors and maſters are men of known talents and capacity. That at Portſmouth was founded by George I. in 1722, for teaching thoſe branches of the mathematics which more immediately relate to navigation.

ACCELERATED *Motion*.
- *on oblique or inclined planes*. See MOTION.
- *of pendulums*. See PENDULUMS.
- *of projectiles*. See PROJECTILES.

ACCENSI, in antiquity, were officers attending the Roman magistrates; their business was to summon the people to the public games, and to assist the prætor when he sat on the bench.

Accensi, in the Roman armies, were, according to Festus, supernumerary soldiers, whose duty it was to attend their leaders, and supply the places of those who were either killed or wounded. Livy mentions them as irregular troops, who were but little esteemed. Salmasius tells us, they were taken out of the fifth class of the poor citizens of Rome.

ACCESSIBLE, that which may be approached. We say, in a military stile, that place, or that fortress, is *accessible* from the sea, or land, i. e. which may be entered on those sides.

An accessible height or distance, in geometry, is that which may be measured by applying a rule, &c. to it; or rather, it is a height, the foot whereof may be approached, and from whence any distance may be measured on the ground.

Heights, both accessible, and inaccessible, may be taken with a quadrant. See ALTITUDE.

One of the objects of surveying, is the measuring both accessible and inaccessible distances.

ACCLIVITY, in a military sense, is the steepness or slope of any work, inclined to the horizon, reckoned upwards. Some writers on fortification use acclivity as synonymous to *talus*; though *talus* is commonly used to denote all manner of slopes, either in its ascendent or descendent state.

ACCOUTREMENTS, in a military sense, signifies habits, equipage, or furniture, of a soldier, such as buffs, belts, pouches, cartridge-boxes, &c.

ACLIDES, in Roman antiquity, a kind of missive weapon, with a thong fixed to it, whereby it might be drawn back again. Most authors describe the *aclides* as a sort of dart or javelin; but Scaliger makes it roundish or globular, with a wooden stem to poise it by.

ACTIAN *games*, in antiquity, were solemn games instituted, or at least restored, by Augustus, in memory of the famous victory, at Actium, over Mark Anthony.

ACTIAN *years*, in chronology, a series of years, commencing with the epocha of the battle of Actium, otherwise called the æra of Augustus.

ACTION, in the military art, is an engagement between two armies, or any smaller body of troops, or between different bodies belonging thereto. The word is likewise used to signify some memorable act done by an officer, soldier, or even commander of a detachment or party.

ACTIVITY, in a military sense, denotes laboriousness, attention, labour, diligence and study.

ACUTE *angle*. See ANGLE.

ADJUTANT-GENERAL is an officer of distinction, who aids and assists the general in his laborious duty: he forms the several details of duty of the army, with the brigade-majors, and keeps an exact state of each brigade and regiment, with a roll of the lieutenant-generals, major-generals, colonels, lieutenant-colonels, and majors. He every day at head quarters receives orders from the general officer of the day, and distributes them to the majors of brigades, from whom he receives the number of men they are to furnish for the duty of the army, and informs them of any detail which may concern them. On marching days he accompanies the general to the ground of the camp. He makes a daily report of the situation of all the posts placed for the safety of the army, and of any changes made in their posts. In a day of battle the adjutant-general sees the infantry drawn up, after which he places himself by the general to receive any orders. In a siege he visits the several posts and guards of the trenches, and reports their situation, and how circumstanced: he gives and signs all orders for skirmishing parties (if time permits) and has a serjeant from each brigade to carry any orders which he may have to send.

ADJUTANT, an officer who eases the major of part of the burthen of his duty, and performs it all in his absence. He receives orders from the brigade-major, if in camp; and when in garrison, from the town-major: after he has carried them to his colonel or officer commanding the regiment, he then assembles the serjeant-major, drum-major, and fife-major, with a serjeant and corporal of each company, who write the orders to shew to their respective officers. If convoys, parties, detachments, or guards, are to be furnished, he gives the number which each company are to furnish, and hour and place for their assembling: he must keep an exact roster and roll of duties, and have a perfect knowledge of all manœuvres, &c. Each troop of guards has two adjutants, every regiment of foot has one, and each battalion of the royal artillery one. This post is always given to a subaltern.

ADVANCEMENT, in a military sense, signifies honour, promotion, or preferment, in the army, regiment, or company.

ADVANCED

ADVANCED { Fosse. Ditch. } See Fortification.
ADVANCED Guard. See Guard.

AFFIDAVIT, in military law, signifies an oath taken before some person who is properly authorized to take it; as first, when a soldier is inlisted; secondly, by all officers appointed for a court-martial; thirdly, by the commissaries, or muster-masters.

AFFUT, the French name for a gun-carriage, and for which we have no proper name; the only distinction from all other carriages is, that it belongs to a gun. See Carriage.

AGA, in the Turkish army, is the same as a general with us.

AGENT, to a regiment or battalion, signifies a person entrusted with all the money belonging to both officers and private men: he keeps exact accounts of the arrears of commissioned officers, in regard to subsistence, poundage, hospital, widows, and off-reckonings. He is generally appointed by the colonel of the regiment.

AGIADES, in the Turkish armies, are a kind of pioneers employed in fortifying the camp, &c. This word frequently occurs in history.

AID-DE-CAMP, an officer appointed to attend a general officer, in the field, in winter-quarters, and in garrison; he receives and carries their orders, as occasion requires. He is seldom under the degree of a captain, and all aids-de-camp have 10s. a day allowed for their duty. This employment is of greater importance than is generally believed: it is, however, often entrusted to young officers of little experience, and of as little capacity; but in most foreign services they give great attention to this article. Marshal de Puysegur mentions the loss of a battle through the incapacity of an aid-de-camp.

King's Aids-de-Camp, are frequently officers of note; and by this promotion they always rank as colonels.

AID-MAJOR. See Adjutant.

AIM-FRONTLET, a piece of wood hollowed out to fit the muzzle of a gun, to make it of an equal height with the breech, formerly made use of by the gunners, to level and direct their pieces. It is not used at present.

AIR-GUN, a pneumatic machine for exploding bullets, &c. with great violence.

The common air-gun is made of brass, and has two barrels: the inside barrel is of a small bore, from whence the bullets are exploded; and a large barrel on the outside of it. There is likewise a syringe fixed in the stock of the gun, by which the air is injected into the cavity between the two barrels through a valve. The ball is put down into its place in the small barrel with the rammer, as in any other gun. Another valve, being opened by the trigger, permits the air to come behind the bullet, so as to drive it out with great force. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with uncommon force. This discharge is effected by means of a lock placed here, as usual in other guns; for the trigger being pulled, the cock will go down and drive the lever, which will open the valve, and let in the air upon the bullet.

In the air-gun, and all other cases where the air is required to be condensed to a very great degree, it will be requisite to have the syringe of a small bore, viz. not exceeding half an inch in diameter; because the pressure against every square inch is about 15 pounds, and therefore against every circular inch about 12 pounds. If therefore the syringe be one inch in diameter, when one atmosphere is injected, there will be a resistance of 12 pounds against the piston; and when 10 are injected, there will be a force of 120 pounds to be overcome; whereas 10 atmospheres act against the circular half-inch piston (whose area is only ¼ part so big) with only a force equal to 30 pounds; or 40 atmospheres may be injected with such a syringe, as well as 10 with the other. In short, the facility of working will be inversely as the squares of the diameter of the syringe.

AIR-SHAFTS, in mining. See Mining.

AJUTANT. See Adjutant.

ALARM, is a sudden apprehension upon some report, which makes men run to their arms to stand upon their guard; it implies either the apprehension of being suddenly attacked, or the notice given of such an attack being actually made; generally signified by the firing of a cannon, the beat of a drum, &c.

Alarm-*Post*, in the field, is the ground appointed by the quarter-master general for each regiment to march to, in case of an alarm.

Alarm-*Post*, in a garrison, is the place allotted by the governor for the troops to draw up in, on any sudden alarm.

False-Alarms, are stratagems of war, frequently made use of to harrass an enemy, by keeping them perpetually under arms. They are often conveyed by false reports, occasioned by a fearful or negligent sentinel. A vigilant

officer will ſometimes make a falſe alarm, to try if his guards are ſtrict upon duty.

Alarm-*Bell*, the bell rung upon any ſudden emergency, as a fire, mutiny, approach of an enemy, or the like.

Knights of ALCANTARA, a Spaniſh military order, who gained great honour during the wars with the Moors.

ALIEN, in law, implies a perſon born in a foreign country, not within the king's dominions, in contradiſtinction to a denizen, or natural-born ſubject.

ALLEGIANCE, in law, implies the obedience which every ſubject ought to pay to his lawful ſovereign.

Oath of Allegiance, is that taken by the ſubject, by which he acknowledges the king his lawful ſovereign.

ALLIANCE, in a military ſenſe, ſignifies a treaty entered into by ſovereign princes and ſtates, for their mutual ſafety and defence. In this ſenſe alliances may be diſtinguiſhed into ſuch as are offenſive, whereby the contracting parties oblige themſelves jointly to attack ſome other power, and into ſuch as are defenſive, whereby the contracting powers bind themſelves to ſtand by, and defend one another, in caſe of being attacked by any other power.

ALLOY, is the mixture of metals that enter into the compoſition of the metal proper for cannon and mortars.

ALMADIE, a kind of military canoe, or ſmall veſſel, about 24 feet long, made of the bark of a tree, and uſed by the negroes of Africa.

Almadie, is alſo the name of a long-boat uſed at Calcutta, near 80 feet long, and generally ſix or ſeven broad.

ALTITUDE, height, or diſtance from the ground, meaſured upwards, and may be both acceſſible and inacceſſible.

Altitude *of motion*, a term uſed by ſome writers, to expreſs the meaſure of any motion, computed according to the line of direction of the moving force.

AMAZON, one of thoſe women who inhabited the country ſo called. They are ſaid to have compoſed a nation of themſelves, excluſive of males, and to have derived their name from their cutting off one of their breaſts, that it might not hinder or impede the exerciſe of their arms. This term has often by modern writers been uſed to ſignify a bold daring woman, whom the delicacy of her ſex does not hinder from engaging in the moſt hazardous attempts. The laſt and former wars with France have furniſhed us with ſeveral inſtances of females who have undergone the fatigue of a campaign with alacrity, and run the hazards of a battle with the greateſt intrepidity.

AMBITION, in a military ſenſe, ſignifies a deſire of greater poſts, or preferment. Every gentleman in the army, or navy, ought to have a ſpirit of ambition to arrive at the very ſummit of their profeſſion.

AMBUSCADE, in military affairs, implies a body of men poſted in ſome ſecret or concealed place, 'till they find an opportunity of falling upon the enemy by ſurpriſe: or, they are rather ſnares ſet for the enemy, either to ſurpriſe them when marching without precaution, or by poſting yourſelf advantageouſly, and drawing them there by different ſtratagems, to attack them by ſuperior force. An ambuſcade is eaſily carried into execution in woods, buildings, and hollow places; but requires a more fertile imagination, and greater trouble, in a level country.

AMBUSH, a place of concealment for ſoldiers to ſurpriſe an enemy, by falling ſuddenly upon them.

AMENDE *Honorable*, in the French cuſtoms, is an infamous kind of puniſhment inflicted upon traitors, paricides, or ſacrilegious perſons, in the following manner: the offender being delivered into the hands of the hangman, his ſhirt is ſtripped off, a rope put about his neck, and a taper in his hand; then he is led into court, where he muſt beg pardon of God, the king, the court, and his country. Sometimes the puniſhment ends here; but ſometimes it is only a prelude to death, or baniſhment to the gallies.

AMMUNITION, implies all ſorts of warlike ſtores, and more particularly powder and ball, cannon, mortars, howitzers, cohorns, royals, ſhells, bullets, cartridges, grape-ſhot, tin, and caſe-ſhot; carcaſſes, granades, pontoons, ſmall-arms, ſwords, forage, ſtores, &c.

Ammunition *bread*, *ſhoes*, *cloths*, &c. ſuch as are ſerved out by the governement, to the ſoldiers of an army, garriſon, &c. The bread that is provided for, and diſtributed to the ſoldiers, is a loaf of ſix pounds every four days to each ſoldier.

Ammunition-*waggon*, is generally a four-wheel carriage with ſhafts; the ſides are railed in with ſtaves and raves, and lined with wicker-work, ſo as to carry bread and all ſorts of tools. It is drawn by four horſes, and loaded with 1200 pound weight. See Waggon.

Ammunition-*cart*, a two-wheel carriage with ſhafts; the ſides of which, as well as the fore

fore and hind parts, are inclosed with boards instead of wicker-work.

AMNESTY, in a military or political sense, is an act by which two belligerent powers at variance promise to forget and bury in oblivion all that is past.

Amnesty is either general and unlimited, or particular and restrained, though most commonly universal, without conditions or exceptions; such as that which passed in Germany at the peace of Osnabrug in the year 1648.

Amnesty, in a more limited sense, denotes a pardon granted by a prince to his rebellious subjects, usually with some exceptions; such as was granted by Charles II. at his restoration.

AMORCE, an old military word for fine-grained powder, such as is sometimes used for priming of great guns, mortars or howitzers; as also for small-arms, on account of its rapid inflammation.

AMPLITUDE *of the range of a projectile.* See Projectile.

ANABASII, in antiquity, were expeditious couriers, who carried dispatches of great importance, in the Roman wars.

ANCYLE, in antiquity, a kind of shield which fell, as was pretended, from heaven, in the reign of Numa Pompilius; at which time, likewise, a voice was heard, declaring that Rome should be mistress of the world as long as she should preserve this holy buckler.

Authors are much divided about its shape: however, it was kept with great care in the temple of Mars, under the direction of twelve priests; and, lest any should attempt to steal it, eleven others were made so like it, as not to be distinguished from the sacred one. These *Ancylia* were carried in procession every year round the city of Rome.

St. ANDREW, *or the Thistle*, a military order of knighthood in Scotland. The occasion of instituting this order is variously related by different authors. John Lesley, bishop of Ross, reports, that the night before the battle betwixt Athelstane, king of England, or rather Northumberland, and Hungus, king of the Picts, a bright cross, in the fashion of that whereon St. Andrew suffered martyrdom, appeared in the air to Hungus; he having gained the victory, bore the figure of that cross at all times after in his ensigns and banners, from which time all succeeding kings of Scotland have religiously observed the same bearing. Others assert, that this extraordinary appearance was not to Hungus, but to the Scots, whom Achaius, king of Scotland, sent to his assistance. This victory is said to be obtained in the year 819 (though, according to Buchanan, Achaius died nine years before) and that Hungus and Achaius went bare footed in solemn procession to the kirk of St. Andrew, to return thanks to God and his apostle, promising that they and their posterity would ever use in their ensigns the cross of St. Andrew; which custom prevailed among the Picts, and continued among the Scots unto this day: and that both these kings instituted an order, which they named the order of St. Andrew.

Others, who allow that Achaius instituted this order, give the following account of its origin: Achaius having formed that famous league, offensive and defensive, with Charlemagne, against all other princes, found himself thereby so strong, that he took for his device the *Thistle* and the *Rue*, which he composed into a collar of his order, and for his motto, *Pour ma defense*; intimating thereby, that he feared not the powers of foreign princes, seeing he leaned on the succour and alliance of the French. And though from hence may be inferred, that these two plants, the Thistle and the Rue, were the united symbols of one order of knighthood, yet Menenius divides them into two, making one whose badge was the Thistle, whence the knights were so called, and the motto, *Nemo me impune lacessit*; another vulgarly called *Sertum rutæ*, or the garland of rue; the collar of which was composed of two branches or sprigs thereof, or else of several of its leaves: however, at both these collars hung one and the same jewel, to wit, the figure of St. Andrew, bearing before him the cross of his martyrdom.

But though the thistle has been acknowledged for the badge and symbol of the kingdom of Scotland, even from the reign of Achaius, as the rose was of England, and the lily of France, the pomegranate of Spain, &c. yet there are some who refer the order of the thistle to later times, in the reign of Charles VII. of France, when the league of amity was renewed between that kingdom and Scotland, by which the former received great succour from the latter, in the time of an extraordinary distress. Others again place the foundation still later, even as low as the year 1500; but without any degree of certainty.

The chief and principal ensign of this order is a gold collar, composed of thistles, interlinked with annulets of gold, having pendent thereto the image of St. Andrew with his cross, and this motto, *Nemo me impune lacessit.*

Knights of St. Andrew, is also an order instituted by Peter the Great, of Muscovy, in 1698; the badge

badge of which is a golden medal, on one side whereof is repretented St. Andrew's cross; and on the other are these words, *Czar Pierre monarque de toute la Russie*. This medal, being fastened to a blue ribbon, is suspended from the right shoulder.

ANGLE, in geometry, is the inclination of two lines meeting one another in a point.

Thus if the line *C B* (*plate I. fig.* 1.) meet the line *D B*, in the point *B*, their inclination towards each other is called an angle.

Sometimes angles are denoted by a single letter placed at the point of intersection; as the angle *B* (*fig.* 2.) imports the angles formed by the lines *A B*, *C B*, at the point *B*. But when several lines meet at the same point, as at *B* (*fig.* 3.) each particular angle is denoted by three letters, whereof the middle letter shews the angular point, and the other two letters the lines which form that angle. Thus the angle formed by the lines *A B*, *C B*, at the point *B*, is called the angle *A B C*, or *C B A*.

The measure of an angle is the arch of a circle, described on the angular point, intercepted between the two lines which form the angle. Thus the measure of the angle *A B C* (*fig.* 3.) is the dotted arch intercepted between the two legs *A B*, *C B*; and as many degrees, &c. as are contained in that arch, so many degrees, &c. the angle *A B C* is said to consist of.

Hence it will be easy to measure the quantity of any angle geometrically; for if you take the distance of the arch intercepted between the lines *A B*, *C B*, and apply it to a line of chords, whose radius is *B E*, you will have the number of degrees, &c. contained in the angle *A B C*. Or if you apply the center of a protractor to the angular point *B*, in such a manner that the leg *A B* lies directly under the limb of the protractor, the degree on the arch cut by the other leg *B C* will give the quantity of the angle required.

ANGLES are either *right*, *acute*, or *obtuse*.

A Right ANGLE, is that whose two legs are perpendicular to each other; and consequently the arch intercepted between them is exactly 90°. Thus the angle *A B C* (*fig.* 2.) is a right angle.

An Acute ANGLE, is that which is less than a right angle, or 90°. as the angle *C B D*, *fig.* 1.

An Obtuse ANGLE, is that which is greater than a right angle; as *A B C*, *fig.* 1.

Adjacent ANGLES, are such as have the same vertex, and one common side contained beyond the angular point. Thus the angle *C B D*, and *C B A* (*fig.* 1.) are adjacent angles. The sum of these adjacent angles is always equal to two right angles (13. *Eucl.* 1.) and therefore, if one of them be acute, the other will be obtuse; and the contrary: whence, if either of them be given, the other is also given, it being the complement of the former to 180°.

Vertical ANGLES, are the opposite angles made by two lines cutting or crossing each other. Thus, if the right lines *A B*, *C B* (*fig.* 4.) cut or cross each other in the point *E*, then the angles *A E C*, *D E B*, and *A E D*, *C E B*, are vertical angles. Hence, when two lines cut or cross each other, the vertical angles are equal (15. *Eucl.* 1.)

Alternate ANGLES, are those cut or obtuse angles made by two lines cutting or crossing each other, and formed by a right line cutting or crossing two parallel lines. Thus, if *A B* (*fig.* 5.) be parallel to *C D*, and the line *G H* cuts them in *I* and *K*, then are the angles *A I K*, *D K I*, and *B I K*, *I K C*, alternate angles. These alternate angles are always equal to each other (18. *Eucl.* 1.)

A Rectilinear ANGLE, is made by strait lines, to distinguish it from the spherical or curvilinear angle.

Spherical ANGLE, is an angle formed by the intersection of two great circles of the sphere. Thus let *A C D E* (*fig.* 6.) represent a sphere, upon whose surface let two arches of great circles *A B*, *C E*, be drawn intersecting each other in *D*; then will *A D C*, *D C A*, *B D E*, or *D B E*, be a spherical angle. All spherical angles are measured by an arch of a great circle described on the vertex as a pole, and intercepted between the legs which form the angle. Thus *A C* is the measure of the spherical angle *A D C*, which is equal to the distance between the poles of the circles *A B*, *C E*.

Mixed-lined ANGLE, is that comprehended between a right line and a curved line; as the angle *A B C* (*fig.* 1.)

Curved-line ANGLE, is that intercepted between two curved lines meeting each other in one point, in the same plane; as the angle *B C A* (*fig.* 8.) which is intercepted between the two curved lines *A C* and *B C*. If the right lines *D C*, *E C*, are equal to the radii of the curves *B C* and *A C*, the right-lined angle *D C E* will be equal to the curved-line angle *A C B*. For, because the angle $D C B = E C A$, therefore, if from each be taken the common angle *D C A*, there will remain the angle $D C E = A C B$.

ANGLE *of Incidence*, is that which the line of direction of a ray of light, &c. makes at the point where it first touches the body it strikes

ſtrikes againſt, with a line erected perpendicular to the ſurface of that body. Thus, if a ray of light, &c. moves in the direction *A B* (*fig.* 3.) till it touches the ſurface *a b c d*, in the point *B*, then will the angle intercepted between *A B*, the line of direction, and the perpendicular *B F*, be the angle of incidence.

ANGLE *of Reflection*, is the angle intercepted between the line of direction of a body rebounding, after it was ſtruck againſt another body, and a perpendicular erected at the point of contact. Thus, if a body moving in the direction *A B* ſtrike the ſurface *a b c d* (*fig.* 3.) in the point *B*, and is reflected in the direction *B C*, the angle, contained between that line and the perpendicular *B F*, is called the angle of reflection. The angle of incidence is always equal to the angle of reflection; and upon this equality the whole ſcience of catoptrics is founded.

ANGLE *at the center*, in fortification, is that which is formed in the center of the polygon or figure, by two lines proceeding from the center, and terminating at the two neareſt angles of the polygon. See FORTIFICATION.

ANGLE *of the curtain*, } That which is made
ANGLE *of the flank*, } by, and contained between, the curtain and the flank.

ANGLE *of the polygon*, that which is made by the meeting of the two ſides of the polygon, or figure in the center of the baſtion. See FORTIFICATION.

ANGLE *of the triangle*, is half the angle of the polygon.

ANGLE *of the baſtion*, or } That which is made
Flanked ANGLE, } by the two faces, being the utmoſt part of the baſtion moſt expoſed to the enemies batteries, frequently called the point of the baſtion. See FORTIFICATION.

Diminiſhed ANGLE, only uſed by ſome foreign engineers, and more eſpecially the Dutch, is compoſed of the face of the baſtion, and the exterior ſide of the polygon.

ANGLE *of the ſhoulder*, or } Is formed by one
ANGLE *of the épaule*, } face, and one flank of the baſtion. See FORTIFICATION.

ANGLE *of the tenaille*, } Is made by two lines
ANGLE *rentrant*, } fichant, that is, the faces of the two baſtions extended, 'till they meet in an angle towards the curtain, and is that which always carries its point towards the outworks. See FORTIFICATION.

ANGLE *of the flank exterior*, is that which is before the center of the curtain, formed by the prolongation of the faces of the baſtion, or by both the fichant lines of defence, interſecting each other on planning a fortification.

ANGLE *of the flank interior*, is formed by the flanked line of defence and the curtain; being that point where the line of defence falls upon the curtain.

ANGLE *of the line of defence*, is that angle made by the flank, and the line of defence.

ANGLE *of the face*, is formed by the angle of the face, and the line of defence produced 'till they interſect each other.

ANGLE *of the baſe interior*, is the half of the figure, which the interior polygon makes with the radius, when they join each other in the center; interſecting the center of the gorges of each baſtion.

ANGLE *of the baſe exterior*, is an angle formed by lines drawn from the center of the figure, to the angle of the exterior polygon, cutting the center of the gorges of each baſtion.

ANGLE *of the gorge*, is that angle formed by the prolongation of the curtains, interſecting each other, in the center of the gorge, through which the capital line paſſes.

ANGLE *of the ditch*, is formed before the center of the curtain, by the outward line of the ditch.

Flanked ANGLE. See ANGLE *of the baſtion*.

Salient ANGLE, } Is that angle which points
ANGLE *ſortant*, } outwards, or towards the country. Such is the angle of the counterſcarp before the point of a baſtion.

Entering ANGLE, or } An angle pointing in-
ANGLE *rentrant*, } wards, as the ſalient angle does outwards. Such is the angle of the counterſcarp before the curtain.

ANGLE *of the counterſcarp*, made by two ſides of the counterſcarp, before the center of the curtain.

ANGLE *of the circumference*, is the mixed angle formed by an arch, drawn from one gorge to another.

Re-entering ANGLE. See *Entering* ANGLE.

ANGLE *of the complement of the line of defence*, is the angle formed by the interſection of the two complements with each other.

ANGLE *of a battalion*, made by the laſt men at the extremity of the ranks and files.

Front ANGLES, the two laſt men of the front rank.

Rear ANGLES, the two laſt men of the rear rank.

Dead ANGLE, is a re-entering angle, conſequently not defended.

ANGULAR, in a general ſenſe, denotes ſomething relating to, or that hath angles.

ANGON, in ancient military hiſtory, was a kind of dart of a moderate length, having an iron bearded head and cheeks; much in uſe about the fifth century.

To ANIMATE, in a military ſenſe, is to encourage the troops by the power of language. That art, that power, which can on ſingular and critical occaſions ſo animate the ſpirit of man, as to cauſe it to give an elaſticity, a ſtrength, a velocity, to the corporeal matter of the being, which unanimated it would be incapable of doing; ſuch art, ſuch power, muſt be ever neceſſary to a leader of ſoldiers. He who is, in particular caſes, to point out to others their duty, who is ſometimes to diſſipate their fears, rouze their courage, ſhew advantages, or leſſen unfavourable appearances, ſhould have the power to animate by ſpeech: if he has not, he himſelf may meet with diſgrace, where he might have found triumph; and his men be beat, where they might have conquered. Innumerable inſtances might be brought to prove the truth of this aſſertion. All addreſſes to animate ſoldiers have been reſerved, and uſed as laſt reſources for rare, trying, and critical ſituations; and in ſuch ſenſe alone is the power *to animate* by ſpeech here treated of.

All officers know, that in any event of danger, the ſoldiers always look at their officers, their commanding one in particular, if they have confidence in him, to ſee how he feels himſelf, whether he is unperplexed, and ſeems to be eaſy; and from his looks they will often augur good or bad ſucceſs; and from his appearance or actions often ſpring aſſurance and victory, diſmay and defeat. Actions or appearances of officers ſhould never lead to give ſoldiers room to doubt, or to form unfavourable conjectures: what they ſee from the enemy cannot be prevented; but they ſhould neither ſee, hear, nor underſtand any bad omens from their own ſide: if they ever ſee too much, means, if poſſible, ſhould be made uſe of, to make them diſtruſt and forget their own ſight, and ſee only through the medium of their commanding officer's words and inclinations. Animation, like electricity, is communicated, is catching; and the officer who is animated himſelf, will inſpire others.

All hiſtory, particularly the ancient, preſents numbers of examples of armies, of ſmall parties, extricating themſelves from dangerous and alarming ſituations, through the exhortations of their chiefs; and when any chief directs the method of eſcape, or ſhews the road to victory, by a few words; and with his perſon, if neceſſary, ſets the example of actual execution, armies, and parts of armies, in general will eſcape, and will conquer. If ſoldiers opinions are then to be changed by words, or by appearances, and from ſuch change of opinion, victory will often enſue; hence to animate by ſpeech at particular times, becomes a matter of the utmoſt importance.

ANNALS, a ſpecies of military hiſtory, wherein events are related in the chronological order they happened. It differs from a perfect hiſtory, in being only a meer relation of what paſſes every year, as a journal is of what paſſes every day.

ANNUNCIADA, an order of military knighthood in Savoy, firſt inſtituted by Amadeus I. in the year 1409; their collar was of 15 links, interwoven one with another, and the motto *F. E. R. T.* ſignifying *fortitudo ejus Rhodum tenuit.* Amadeus VIII. changed the image of St. Maurice, patron of Savoy, which hung at the collar, for that of the Virgin Mary; and inſtead of the motto above mentioned, ſubſtituted the words of the angel's ſalutation.

ANOLYMPIADES. See Olympiad.

ANSPESADE. See Lance Corporal.

ANTEMURALE, in the ancient military art, denotes much the ſame with that the moderns call the outworks.

ANTESTATURE, in ancient fortification, ſignifies an intrenchment of palliſades or ſacks of earth, thrown up in order to diſpute the remainder of a piece of ground.

ANTHONY, or *Knights of St. Anthony*, a military order inſtituted by Albert, duke of Bavaria, Holland, and Zeland, when he deſigned to make war againſt the Turks in 1382. The knights wore a collar of gold made in the form of a hermit's girdle, from which hung a ſtick like a crutch, with a little bell, as they are repreſented in St. Anthony's pictures.

APPAREILLE, are thoſe ſlopes that lead to the platform of the baſtion. See Fortification.

Appareilles, are eaſy aſcents leading to the works, or platforms, of a fortification.

APPOINTE, a foot ſoldier, who, for his long ſervice and extraordinary bravery, receives pay above the private ſentinels, and expects to be advanced. This is in France only.

APPOINTMENT, in a military ſenſe, is the pay of the army; likewiſe applied to warlike habiliments, accoutrements, &c.

APPROACHES. All the works are generally ſo called that are carried on towards a place that is beſieged; ſuch as the firſt, ſecond, and third parallels, the trenches, epaulements with and without trenches, redouts, places of arms, ſaps,

saps, galleries, and lodgments. See these words more particularly at the word FORTIFICATION.

This is the most difficult part of a siege, and where most lives are lost. The ground is disputed inch by inch, and neither gained nor maintained without the loss of men. It is of the utmost importance to make your approaches with great caution, and to secure them as much as possible, that you may not throw away the lives of your soldiers. The besieged neglect nothing to hinder the approaches; the besiegers do every thing to carry them on; and on this depends the taking or defence of the place.

The trenches being carried to their glacis, you attack and make yourself master of their covered-way, make a lodgement on the counterscarp, and a breach by the sap, or by mines with several chambers, which blow up their intrenchments and fougades, or small mines, if they have any.

You cover yourselves with gabions, fascines, barrels, or sacks; and if these are wanting, you sink a trench.

You open the counterscarp by saps to make yourself master of it; but, before you open it, you must mine the flanks that defend it. The best attack of the place is the face of the bastion, when by its regularity it permits a regular approach and attacks according to art. If the place be irregular, you must not observe regular approaches, but proceed according to the irregularity of it; observing to humour the ground, which permits you to attack it in such a manner at one place, as would be useless or dangerous at another; so that the engineer who directs the attack ought exactly to know the part he would attack, its proportions, its force, and solidity, in the most geometrical manner.

APPROACHES, in a more confined sense, signify attacks.

Counter APPROACHES, are such trenches as are carried on by the besieged, against those of the besiegers.

APRON, in *gunnery*, a square plate of lead that covers the vent of a cannon, to keep the charge dry, and the vent clean and open.

Their dimensions are as follow, viz. for a 42, 32, and a 24 pounder, 15 inches by 13; for an 18, 12, and a 9 pounder, 12 inches by 10; for a 6, 5½, 3, and 1½ pounder, 10 inches by 8. They are tied fast by two strings of white marline, the length of which, for a 42 to a 12 pounder inclusive, is 18 feet, 9 feet each string; for a 9 to 1½ pounder, 12 feet, 6 feet for each.

AQUEDUCT, a channel to convey water from one place to another. The Romans had aqueducts which extended 100 miles. That of Louis XIV. near Maintenon, which carries the river Bute to Versailles, is 7000 toises long, &c.

ARAIGNEE, in *fortification*. See GALLERY.

ARCH, in *military architecture*, is a vault or concave building, in form of a curve, erected to support some heavy structure, or passage.

Triumphal ARCH, in *military history*, is a stately gate, generally of a semicircular form, adorned with sculpture, inscriptions, &c. erected in honour of those heroes who have deserved a triumph.

ARCHERY, is the art of shooting with a bow. Our ancestors were famous for being the best archers in Europe, and most of our victories in France were the purchase of the long-bow. The statutes made in 33 Hen. VIII. relative to this exercise, are worth perusal, and would afford noble hints towards rendering our militia invincible.

ARCHITECTURE, in a *military sense*, is the art of erecting all kinds of military edifices or buildings, whether for habitation or defence.

Military ARCHITECTURE, instructs us in the method of fortifying cities, sea-ports, camps, building powder magazines, barracks, &c. See FORTIFICATION.

Naval ARCHITECTURE, is the art of building the hull, or body of the ship, distinct from her machinery and furniture for sailing; and may properly be comprehended in three principal articles. 1. To give the ship such a figure, or outward form, as may be most suitable to the service for which she is intended. 2. To find the exact shape of the pieces of timber necessary to compose such a fabric. 3. To make convenient apartments for the artillery, ammunition, provisions and cargo; together with suitable accommodations for the officers and men.

ARCHITRAVE, the master beam, or chief supporter, in any part of a subterraneous fortification.

AREA, the superficial content of any rampart, or other work of a fortification.

ARM, in *geography*, denotes a branch of the sea, or of a river.

ARM is also used figuratively to denote power.

To ARM, to take arms, to be provided against an enemy, or casualty.

ARMADA, a Spanish term, signifying a

fleet of men of war, applied particularly to that great one fitted out by the Spaniards, with an intention to conquer this island in 1588.

ARMADILLA, a Spanish term, signifying a small squadron.

ARMATURA, in *ancient military history*, signifies the fixed and established military exercise of the Romans, nearly in the sense we use the word Exercise.

ARMED, in a general sense, denotes something provided with, or carrying arms.

An ARMED *body of men*, denotes a military detachment, provided with arms and ammunition, ready for an engagement.

ARMED, in the *sea language*. A cross-barshot is said to be armed, when some rope-yarn, or the like, is rolled about the end of the iron bar which runneth through the shot.

ARMED *ship*, is a vessel taken into the government's service, and equipped by them, in time of war, with artillery, ammunition, and warlike instruments: it is commanded by an officer who has the rank of master and commander in the navy, and upon the same establishment with sloops of war, having a lieutenant, master, purser, surgeon, &c.

ARMILUSTRIUM, in *Roman antiquity*, a feast held among the Roman generals, in which they sacrificed, armed, to the sound of trumpets, and other warlike instruments.

ARMISTICE, a temporary truce, or cessation of arms for a very short space of time only.

ARMORY, a warehouse of arms, or a place where the military habiliments are kept, to be ready for use.

ARMOUR, denotes all such habiliments as serve to defend the body from wounds, especially darts, a sword, a lance, &c. A complete suit of armour formerly consisted of a helmet, a shield, a cuirasse, a coat of mail, a gantlet, &c. now almost universally laid aside.

ARMOUR-BEARER, he that carries the armour of another.

ARMOURER, a person who makes or deals in armour, or arms; also a person who keeps them clean.

ARMS, in general, all kinds of weapons, whether used for offence or defence. In a legal sense, arms may extend to any thing that a man wears for his own defence, or takes in his hand, and uses in anger, to strike, throw at, or wound another.

Bells of ARMS, a kind of tents in the shape of a cone, where the company's arms are lodged in the field. They are generally painted with the colour of the facing of the regiment, and the king's arms in front.

Pass of ARMS, a kind of combat, when anciently one or more cavaliers undertook to defend a pass against all attacks.

Place of ARMS. See FORTIFICATION.

Stand of ARMS, a complete set of arms for one soldier.

ARMS, in *artillery*, are the two ends of an axletree. See AXLETREE, under the word CARRIAGE.

Fire-ARMS, are great guns, firelocks, carbines, guns and pistols; or any other machine discharged by inflamed powder.

ARMY, a large number of soldiers, consisting of artillery, foot, horse, dragoons, and hussars or light-horse, completely armed, and provided with engineers, a train of artillery, ammunition, provisions, commissariate, forage, &c. and under the command of one general, having lieutenant-generals, major-generals, brigadiers, colonels, lieutenant-colonels, majors, captains, and subalterns. An army is composed of brigades, regiments, battalions, and squadrons; and is generally divided into three or more corps, and formed into three lines; the first of which is called the front-line, a part of which forms the van-guard; the second, the main body; and the third, the rear-guard, or corps of reserve. The centre of each line is generally possessed by the foot; the cavalry form the right and left wings of each line; and sometimes a squadron of horse is posted in the intervals between the battalions. When an army is drawn up in order of battle, the horse are frequently placed at five feet from each other, and the foot at three. In each line the battalions are distant from each other about 180 feet, which is nearly equal to the extent of their front; and the same holds good of the squadrons, which are about 300 feet distant, the extent of their own front. These intervals are left for the squadrons and battalions of the second line to range themselves against the intervals of the first, that both may more readily march thro' those spaces to the enemy. The front line is generally about 300 feet from the centre line; and the centre line as much from the rear, or corps of reserve; that there may be sufficient room to rally when the squadrons or battalions are broken.

A naval or sea ARMY, is a number of ships of war, equipped and manned with sailors, mariners, and marines, under the command of an admiral, with the requisite inferior officers under him.

Flying ARMY, a strong body of horse and foot, commanded for the most part by a lieutenant-general, which is always in motion, both to cover its own garrisons, and to keep the

army

army in continual alarm. It is alſo uſed for the ground on which ſuch a body of men encamps.

Wings of an ARMY. See WINGS.

ARREARS, in *the army*, is the difference between the full pay and ſubſiſtence of each officer, which is always paid once a year by the agent. See PAY.

ARROW. See FORTIFICATION.

ARSENAL, in a large and well-fortified town, is a large and ſpacious building, in which are depoſited all kinds of arms, and other warlike implements; ſuch as cannon, mortars, howitzers, ſmall arms, and every other kind of warlike engines and inſtruments of death, which ſhould be kept clean, and in good and ſerviceable repair, under the direction of a ſtore-keeper and artiſans.

ARTICLES OF WAR, are thoſe known rules and regulations for the better government of the army in the kingdoms of Great-Britain and Ireland, dominions beyond the ſeas, and foreign parts: they are in number 27, beſides thoſe for the adminiſtration of juſtice, which are 23, and the additional articles for the entry of commiſſions, effects of the dead, artillery, and the American troops.

ARTILLERY, in *a general ſenſe*, ſignifies all ſorts of great guns or cannon, mortars, howitzers, petards, and the like; together with all the apparatus and ſtores thereto belonging, which are not only taken into the field, but likewiſe to ſieges, and made uſe of both to attack and defend fortified places. See ORDNANCE.

ARTILLERY, in *a particular ſenſe*, ſignifies the ſcience of artillery or gunnery, which art includes geometry, trigonometry, conic ſections, laws of motion, mechanics, and projectiles.

Train of ARTILLERY, an unlimited number of pieces of ordnance; ſuch as 24 pounders, 18 pounders, 12, 9, 6, and 3 pounders; mortars from 13 to 8 inches diameter; beſides royals and cohorns; howitzers of every denomination, mounted on their proper carriages and beds, &c. Beſides, to the train belongs a ſufficient quantity of horſes, ſpare carriages, ſpare mortar-beds, block-carriages, limbers, waggons for ammunition and ſtores, ſhells, round and grape ſhot, bullets, powder, cartridges, portfires, intrenching-tools, artificers tools, miners tools, gins, capſtans, forges, ſmall ſtores, laboratory-ſtores, pontoons, pontoon-carriages, with their requiſites; tumbrels, aprons of lead, budge-barrels, chevaux de frize, palliſades, platforms, chandeliers, blinds, drag-ropes, flints, harneſs, powder-meaſures, fuze-engines, fuzes, tents, &c. The train of artillery is, or ſhould be, divided into brigades, to which belong not only the officers of the regiments of artillery, but even the civil-liſt, ſuch as comptrollers, commiſſaries of ſtores, clerks of ſtores, artificers of all denominations, conductors, ſtore-keepers, waggon-maſters, drivers, &c. The increaſe of artillery clearly demonſtrates its great utility; for in the year 1500, an army of 50,000 men had only 40 pieces of cannon in the field; and in the year 1757, the ſame number of troops brought 200 pieces into the field, including mortars and howitzers.

Brigade of ARTILLERY, generally conſiſts of 8 or 10 pieces of cannon, with all the machinery, and officers to conduct them, and all the apparatus thereto belonging.

ARTILLERY-*Park*, is that place appointed by the general of the army, to incamp the train of artillery, apparatus, ammunition, as well as the battalions of the artillery, appointed for its ſervice and defence. The figure of the park of artillery, is that of a parallelogram, unleſs the ſituation of the ground renders another neceſſary.

The park of artillery is generally placed in the centre of the ſecond line of incampment, and ſometimes in the rear line, or corps of reſerve. In both places the muzzles of the guns are in a line with the fronts of the ſerjeants tents of the regiments of artillery and infantry. Some generals chuſe to place the park about 300 paces before the centre of the front line of the army. But let the ſituation be where it will, the manner of forming the park is almoſt every where the ſame, except that ſome artillery officers differ in the diſpoſition of the carriages; others again divide the equipage as well as the guns into brigades, placing the firſt in the front line, the ſecond in the next, and ſo on. However, the beſt, in my humble opinion, and the moſt approved method, is to divide the whole into brigades, placing the guns of the firſt to the right of the front line, and their ammunition behind them, in one or more lines; and the different brigades to be all numbered, with every waggon thereto belonging. Example, 1ſt brigade, front line, No. 1, 2, &c. 1ſt brigade, 2d line, No. 1, 2, &c. 2d brigade, front line, No. 1, 2, &c. and ſo of all the reſt. This method will prevent confuſion in forming and breaking up of the park, as alſo on a march: beſides, according to the numbers, the ſtores therein contained are known.

Plate II. is the plan of ſuch a park of artillery, as is cuſtomary in the Pruſſian army; conſiſting in 80 cannon, 20 mortars, 20 howitzers, 20 pontoons, 3 forges, and 433 waggons, with 2595 horſes, and 649 drivers, ranged as follows. First

First line, 20 six-pounders, 20 twelve pounders, 20 six-pounders; 60 in all.

Second line, 2 spare carriages, 18 waggons with balls and cartridges, 4 carriages, 32 waggons with balls, 4 carriages, 17 waggons with balls, 3 carriages; 80 in all.

Third line, 5 spare carriages, 33 waggons with balls, 3 ditto with port-fires and matches, 32 ditto with cartridges and grape-shot, 6 carriages; in all 79.

Fourth line, 20 howitzers, 40 waggons with shells, fuzes fixed, 20 mortars; in all 80.

Fifth line, 4 carriages, 12 powder carts, 2 waggons with howitzer grape-shot, 40 ditto with grenades, 18 ditto with musket-balls; in all 76.

Sixth line, 80 waggons with musket-cartridges.

Seventh line, 24 waggons with intrenching tools, 20 pontoons with the requisites for forming bridges, 2 waggons with extraordinaries for ditto, 20 ditto with musket-cartridges, 4 ditto with artificers tools, 3 forges, 7 spare waggons; in all 80. Each carriage takes up 6 feet, and they are placed at the same distance from each other in the lines, which makes room sufficient for loading or unloading them. The second line is 90 feet behind the first; all the rest are 60 feet from each other.

Under the term *Artillery-park*, is to be considered the method of incampment for the regiments of artillery, and every thing thereto belonging, which is as follows, viz.

Incampment of a regiment of ARTILLERY: they are always incamped, half on the right, and half on the left of the park. The company of bombardiers (when formed into companies, which is in almost every nation excepting England) always takes the right of the whole, and the lieutenant-colonels company the left; next to the bombardiers, the colonels, the majors, &c. so that the two youngest are next but one to the centre or park: the two companies next to the park, are the miners on the right, and the artificers on the left. See PLATE II.

In the rear of, and 30 feet from the park, are incamped the civil list, all in one line.

The breadth between the front tent-pole of one company, and that of another, called the streets, are 36 feet each.

	FEET
From the front pole of officers tent of the quarter-guard, or guard of the army, to the centre of the bells of arms of ditto, is	24
To the parade of the quarter-guard	12
To the first line of the regimental parade	150
To the centre of the bells of arms	90
From thence to the front poles of serjeants tents	12
For pitching 12 tents of artillery, with their proper intervals, at 9 feet each	108
From the rear of companies tents, to the front of the subalterns tents	60
From the front of the subalterns, to that of the captains	72
From the front of the captains, to that of the field officers	72
From the front of the field officers, to that of the colonels	36
From the front of the colonels, to that of the staff officers	48
From the front of the staff officers, to the front row of batmans tents	54
From thence to the first row of pickets for horses	6
From thence to the second row	36
From thence to the second row of batmans tents	6
From thence to the front of the grand suttler's tent	42
From thence to the centre of the kitchens	60
From thence to the front of petit-suttler's tents	45
From thence to the centre of the bells of arms of the rear-guard	45
Total depth	978

The army-guard is in the front of the park, opposite the alarm-guns, in a line with the artillery quarter-guards that are placed on the right and left of the artillery companies.

The bells of arms front the poles of serjeants tents.

The colours are placed in the centre of the front line of guns, in the interval of the two alarm-guns, in a line with the bells of arms of the companies.

The lieutenant-colonels and majors tents front the centres of the second streets from the right and left of the regiment.

The colonel's tent is in a line with the colours and guard of the army, facing the same.

The staff-officers front the centres of the second streets, on the right and left of the angles of the park.

The batmans tents front towards their horses.

The rear-guard front outwards. The front-poles are in a line with the centre of their bells of arms, and each 18 feet distant. The parade of

of the rear-guard is 12 feet from the bells of arms.

In the rear of the rear-guard, and 80 feet diſtance from their parade, the artillery-horſes and drivers tents are placed, in two or more lines, parallel with the line of guns, extending from the right and left of the whole.

It ſometimes happens that a very large train of artillery is in the field, with two or more regiments: then the oldeſt takes the right of the park; the next oldeſt the left, and the youngeſt the centre: then the centre or grand ſtreet is 63 feet broad, oppoſite which the tent of the commanding-officer is placed. In the centre of this ſtreet, the colours are placed in a line with the bells of arms, and the artillery quarter-guard in the front of the colours, at the ſame diſtance as before mentioned. See Plate II.

Regiment of Artillery. The corps of artillery, with all its dependencies, is, as it were, the general inſtrument of the army, and without it nothing can be done. It is impoſſible to attack fortified places, or to defend them, without artillery; and an army in the field, without, can never make head againſt one well provided with it. For this reaſon it is, that at all times ſovereigns have taken great care to provide proper officers of learning and capacity to govern, repair and keep in order, this eſſential part of military force.

The ſtrength of a regiment of artillery depends upon the choice of the prince, the quantity of troops he maintains, and more eſpecially on the ſituation of the country, number of fortifications, and foreign eſtabliſhments to be defended. It has always been a prevailing cuſtom, to regulate the corps of artillery according to the French method; but, ſince the famous preſent king of Pruſſia has fixed his regiments of artillery on quite another plan, we chuſe here firſt to explain our own method, and afterwards that of the king of Pruſſia, and to let the candid reader judge for himſelf, which method is the beſt.

Engliſh Artillery, in the reign of Edward VI. and about the year 1548, conſiſted in the following eſtabliſhment, viz.

			£.	s.	d.	£.	s.	d.
Maſter of Artillery,	Sir Philip Hoby,	Fee	0	0	0	151	11	8
Lieutenant,	Sir Francis Fleming,	Fee	0	0	0	66	13	4
Surveyor,	Anthony Anthony,	Fee	0	0	0	36	10	0
Clerk,	John Rogers,	Fee	0	0	0	12	3	4
		In room of a ſervant	0	0	0	12	3	4
Yeoman,	Thomas Sheventon	Fee	0	0	0	9	2	6
		In room of a ſervant	0	0	0	18	5	0
Maſter Gunner,	Chriſtian Gold,	Fee	0	1	0	18	5	0
Gun-ſtock Maker,	Symond Turner,	Fee	0	0	6	9	2	6
Gun-founders	John Owen,	Fee	0	0	8	12	3	4
	Thomas Owen,	Fee	0	0	8	12	3	4
Gun-ſmith,	John Anthony	Fee	0	0	6	9	2	6
Artificer, or Engineer,	John Pudney,	Fee	0	0	4	6	1	8
Maſter Carpenter,	John Johnſon,	Fee	0	0	8	12	3	4
109 Gunners, whereof	15 at 12d	a day each	0	15	0	273	15	0
	12 at 8d	a day each	0	8	0	146	0	0
	80 at 6d	a day each	2	0	0	730	0	0
	2 at 4d	a day each	0	0	8	12	3	4
Total charges of the artillery for one year						1547	9	2

In the 109 gunners above mentioned, are included fees to the following perſons, viz.

To the	Clerk, John Rogers,	at 8d	a day.
	Maſter-gunner,	at 12d	a day.
	Yeoman	at 12d	a day.
To John Owen, Gun-founder,		at 12d	a day.

So that only 105 effective gunners remain.

The eſtabliſhment of artillery in the reign of queen Elizabeth, eſpecially in the year 1597, is as follows, viz.

Allowances to officers within one quarter, ending the laſt of March, 1597, viz.

To Sir George Carew, knight, lieutenant of her Majeſty's ordnance, for his allowance one quarter - - - - - - - £. xviii

To

	£.	s.	d.
To William Parkeringe, surveyor of her majesty's ordnance, for his like quarter's allowance	xviii		
To Stephen Riddlesden, clerk of her majesty's ordnance, for his like quarter's allowance, ...	xvii	xii	
To John Lee, keeper of her majesty's stores, ditto	x		
To George Hogge, and John Linewrayce, clerks of the deliveries, ditto	xiii	xi	iiii
To William Cudner, clerk to Sir George Carew, knight, ditto .	iiii	xi	ii

Clerks daily attending in the said office, for three months, viz.

	£.	
Richard Palfreyman, ...	v	
Edward Parkeringe, ...	v	
William Scott, ...	v	
Richard Haynes	v	 xxxv
Thomas Lemmon	v	
John Squire	v	
Richard Lentall, ...	v	

£. vxviii xvii vi

That is £518 17 6 for one quarter's salary.

These two last accounts are taken from a manuscript of the late Rev. William Gostling's, and very obligingly communicated to me by capt. William Gostling, of the royal artillery.

The establishment of artillery in the reign of James I. and in the year 1618, is as follows, viz.

1 General of artillery.
1 Lieutenant of artillery.
1 Comptroller.
1 Commissary.
10 Gentlemen } of artillery.
25 Conductors } of artillery.
6 Engineers.
2 Comptrollers of fortifications.
1 Master gunner.
136 Gunners.
1 Master fire-worker.
2 Conductors of fire-works.
2 Battery-masters.
1 Petardier.
1 Master carpenter.
12 Carpenters.
2 Waggon } makers.
2 Gabion } makers.
2 Harness } makers.
1 Cooper.
2 Farriers.
1 Surgeon.
1 Surgeon's mate.
1 Captain of miners.
25 Miners.
1 Captain of pioneers.
25 Pioneers.
1 Trench } master.
1 Waggon } master.
1 Carriage } master.
1 Provost.

In 1628, and probably long before, the artillery had sundry privileges, from which the rest of the army were exempt, viz. of having the first rank and the best quarters; neither could any carriage or waggon presume to march before theirs, except that belonging to the treasurer.

In 1705, I find the first mention is made of the royal regiment of artillery, being before that time only called the train of artillery. It then consisted only of 4 companies, under the command of general Borgard. From that period it has gradually increased to 4 battalions, each battalion consisting of 10 companies, (2 of them invalids) commanded by a colonel commandant, a lieutenant-colonel and major, who have no companies. Each company in war time generally consists of 100 men, commanded by 1 captain, 1 captain lieutenant, 1 first, and 3 second lieutenants. In time of peace the companies are reduced to 50 men each.

When Frederick the second, king of Prussia, came to the crown, he found the army in a very good condition, excepting the corps of artillery and engineers, which consisted chiefly in mechanicks and artisans, scarcely looked on by the rest of the army and the officers without commissions. His majesty, knowing how necessary it was to have a good corps of artillery and engineers, and how impossible this was without having officers learned in every branch of the military mathematics; he immediately draughted all the illiterate officers into the garrison regiments, supplying their places with gentlemen of examined capacity; gave them all commissions, rank with the officers of the guards, and an extraordinary pay. This method of proceeding established the honour and

and reputation of that royal and noble corps, on a very respectable footing; induced the nobility and men of rank (provided they had capacity) to engage in those corps sooner than elsewhere; which has brought it to that summit of high renown, they at this time enjoy.

The Prussian artillery consists in 12 battalions, 8 for the field, and 4 for garrison. Each battalion has 12 companies, namely, 1 company of bombardiers, 1 of miners, 1 of artificers, and 9 of artillery. The first, or bombardier companies, are composed of 1 captain, 2 lieutenants, 3 upper and 6 under fire-workers, 2 serjeants, 4 corporals, 2 drummers, and 60 bombardiers. The miners have the same commissioned officers, with 3 serjeants, 6 corporals, 2 drummers, 33 miners, and 33 sappers. The artificers have the same officers and non-commissioned officers as the miners, with 30 artificers and 36 pontoneers. All the artillery companies have 3 commissioned and 6 non-commissioned officers, 2 drummers, and 60 artillerists. The colonel, lieutenant-colonel, and major's companies, have each a captain-lieutenant; and each battalion has further, 1 chaplain, 1 auditor, 1 adjutant, 1 quarter-master, 1 doctor, 3 surgeons, 1 serjeant-major, 1 drum-major, 6 musicians, and 1 provost.

March of the ARTILLERY. The marches of the artillery are, of all the operations of war, the most delicate; because they must not only be directed on the object you have in view, but according to the movements the enemy make. Armies generally march in 3 columns, the centre column of which is the artillery: should the army march in more columns, the artillery and heavy baggage march nevertheless in one or more of the centre columns; the situation of the enemy determines this. If they are far from the enemy, the baggage and ammunition go before or behind, or are sent by a particular road; an army in such a case cannot march in too many columns. But should the march be towards the enemy, the baggage must absolutely be all in the rear, and the whole artillery form the centre column, except some brigades, one of which marches at the head of each column, with guns loaded and burning matches, preceded by a detachment for their safety.

Suppose the enemy's army in a condition to march towards the heads of your columns: the best disposition for the march is in 3 columns only; that of the centre for the artillery; for it is then easy to form them in order of battle. Hence it is equally commodious for each brigade of artillery to plant themselves at the head of the troops, in the places marked for them, in such a manner that the whole disposition being understood, and well executed, they may form quickly in order of battle in an open country, and in the presence of any enemy, without risquing any surprize; by which method the artillery will always be in a condition to act as soon as the troops, provided they march in brigades.

Is your march through a country full of defiles, some dragoons should march at the head of the columns, followed by a detachment of grenadiers, and a brigade of artillery; cannon being absolutely necessary to obstruct the enemy's forming into order of battle.

When you decamp in the face of the enemy, you must give most attention to your rear-guard. On such occasions, all the baggage, ammunition, provisions, and artillery, march before the troops; your best grenadiers, best cavalry, some good brigades of infantry, together with some brigades of artillery, form the rear-guard. Cannon is of infinite use for a rear-guard, when obliged to pass a defile, or a river; and should be placed at the entry of such defile, on an eminence, if there is one, or on any other place, from whence they can discover the ground through which the enemy must march to attack the rear-guard.

A detachment of pioneers, with tools, must always march at the head of the artillery, and of each column of equipage or baggage.

If the enemy is encamped on the right flanks of the march, the artillery, &c. should march to the left of the troops, and vice versa. Should the enemy appear in motion, the troops front that way, by wheeling to the right or left by divisions; and the artillery, which march in a line with the columns, pass through their intervals, and form at the head of the front line, which is formed of the column who flanked nearest the enemy, taking care at the same time that the baggage be well covered during the action.

Though we have said armies generally march in 3 columns, yet where the country will allow it, it is better to march in a greater number; and let that number be what it will, the artillery must form the centre columns.

Line of march of the ARTILLERY. 1. A guard of the army; its strength depends on the commander in chief.

2. The companies of miners (excepting a detachment from each, dispersed in various places, to mend the roads) with tumbrels of tools, drawn by 2 horses, assisted by pioneers.

3. The

3. The brigades of artillery's front guard, with four light 6 pounders loaded, and matches burning.

4. The kettle-drums by 4 horfes, and 2 trumpeters on horfe-back.

5. The flag-gun, drawn by 12 horfes, and ten 12 pounders more, by 4 horfes each.

6. Twenty waggons with ftores for the faid guns, and 1 fpare one, by 4 horfes each.

7. All the pontoons, with the waggons thereto belonging.

8. Eight 9 pounders, by 3 horfes each.

9. Fifteen waggons with ftores for faid guns, by 4 horfes each, and 2 fpare ones.

10. Gins and capftans, with their proper workmen, 3 waggons, with 2 horfes each.

11. A forge on 4 wheels, and 1 waggon, 4 horfes each.

12. Twelve heavy 24 pounders, by 16 horfes each.

13. Sixteen waggons with ftores for ditto, and 2 fpare ones, by 4 horfes each.

14. A waggon with tools, and pioneers to mend the roads.

15. Nine light 24 pounders, by 8 horfes each.

16. Twelve waggons with ftores for ditto, and 2 fpare ones, by 4 horfes each.

17. A forge and waggon, by 4 } horfes each
18. Nine 24 pounders, by 8 }

19. Twelve waggons with ftores for ditto, and 2 fpare ones.

20. Twelve 12 pounders, by 8 horfes each.

21. Sixteen waggons with ftores for ditto, and 2 fpare ones.

22. Sixteen 5.8 inch mortars, by 2 horfes each.

23. Twenty-five waggons with ftores for ditto, and 2 fpare ones.

24. Ten 8 inch mortars, by 4 horfes each.

25. Twenty waggons with ftores for ditto, and 2 fpare ones.

26. Six 10-inch howitzers, by 6 horfes each.

27. Twenty waggons with ftores for ditto, and 2 fpare ones.

28. A waggon with tools, and men to mend the roads.

29. A forge and waggon, by 4 horfes each.

30. Ten 8-inch mortars, by 4 horfes each.

31. Twenty waggons with ftores for ditto, and a fpare one.

32. Sixteen 12-inch mortars, by 8 horfes each.

33. Thirty waggons with ftores for ditto, and 2 fpare ones.

34. Eight 18-inch ftone mortars, by 10 horfes each.

35. Sixteen waggons with ftores for ditto, and a fpare one.

36. Eight 9-pounders, by 3 horfes each.

37. Sixteen waggons, with ftores for ditto, and a fpare one.

38. Twenty 6-pounders, by 2 horfes each.

39. Twenty waggons, with ftores for ditto, and a fpare one.

40. Two fling-waggons, and 2 truck-carriages, 4 horfes each.

41. Twenty 3-pounders, by one horfe each.

42. Ten waggons, with ftores for ditto, and a fpare one.

43. A waggon, with tools, &c.

44. A forge and waggon, by 4 horfes each.

45. Twelve 2 and 1-pounders, by 1 horfe each.

46. Six waggons, with ftores for ditto.

47. Sixteen 6-pounders, by 2 horfes each.

48. Ten waggons, with ftores for ditto.

49. Twenty fpare carriages, for various calibres.

50. Eighteen ditto.

51. Fifty fpare limbers.

52. Ten 18-pounders, by 6 horfes each.

53. Twenty waggons, with ftores for ditto, and 2 fpare ones.

54. Twenty waggons, with ammunition and ftores.

55. Two 12-pounders, by 4 horfes each.

56. Four waggons, with ftores for ditto.

57. Fifty waggons, with ftores.

58. A waggon, with tools, and men to mend the roads.

59. A forge and waggon, by 4 horfes each.

60. A hundred waggons, with ftores, and 4 fpare ones.

61. Four 2 and 1-pounders, by 1 horfe each.

62. A hundred waggons, with ftores, and 3 fpare ones.

63. Two hundred waggons, and 2 fpare ones.

64. Two hundred and fourteen waggons belonging to the artillery baggage; fome with 4, 3, and 2 horfes each.

65. The artillery rear-guard.

66. The rear-guard from the army.

Officers of Artillery. The commander in chief of the artillery is one of the moft laborious employments, both in war and peace, requiring the greateft ability, application, and experience. The officers in general fhould be great mathematicians and engineers, to know all the powers of artillery, the attack and defence of fortified places; together with every thing belonging to that very important corps.

Artillery *Company*, a band of infantry, consisting of 600 men, making part of the militia, or city guard of London.

ASCENT. See Gunnery.

ASSAULT, a furious effort to carry a fortified post, camp, or fortress, where the assailants do not screen themselves by any works. While an assault during a siege continues, the batteries cease, for fear of killing their own men. An assault is sometimes made by the regiments that guard the trenches of a siege, sustained by detachments from the army.

To give an Assault, is to attack any post, &c.

To repulse an Assault, to cause the assailants to retreat, to beat them back.

To carry by Assault, to gain a post by storm, &c.

ASSEMBLEE, the second beating of a drum before a march; at which the army strike their tents, roll them up, and stand to arms. See Drum.

ASTRAGAL. See Cannon.

ATTACK, a general assault, or onset, that is given to gain a post, or break a body of troops.

Attack *of a siege*, is a furious assault made by the besiegers by means of trenches, galleries, saps, breaches, or mines, &c. by storming any part of the front attack. Sometimes two attacks are carried on at the same time, between which a communication must be made. See Siege.

False Attacks, are never carried on with that vigour and briskness that the others are the design of them being to favour the true attack, by amusing the enemy, obliging the garrison to a greater duty in dividing their force, that the true attack may be more successful.

Regular Attack, is that which is carried on in form, according to the rules of art. See Siege.

To Attack *in front or flank*, in fortification, is meant to attack the salient angle, or both sides of the bastion; but when meant to attack a body of men, is a phrase well known.

AVANT-FOSSE. See Fortification.

AVENUE, in fortification, is any kind of opening or inlet into a fort, bastion, or out-work.

AUGERS. See Mining.

AUGMENT, or *Augmentation*, in a military sense, implies advancement of posts, augmentation of troops, &c.

AXLE-TREE { of a carriage. / bar. / bolts. / hoops. / stays. } See *Carriages*.

B

BACULE, in *fortification*, implies a kind of port-cullis or gate, made like a pit-fall, with a counterpoise, and supported by two strong pieces of timber. It is usually placed before the corps de garde, not far from the great gate of the place.

BAGGAGE, in *military affairs*, signifies the clothes, tents, utensils of divers sorts, and provisions, &c. belonging to an army.

Baggage-*Waggons*. See Waggons.

BAGONET. See Bayonet.

BAGPIPE, the name of a well-known warlike instrument, of the wind kind, greatly used by the Scotch regiments, and sometimes by the Irish. Bagpipes are supposed to be introduced by the Danes; but I am of opinion they are much older, as there is in Rome a most beautiful bass-relievo, a Grecian sculpture of the highest antiquity, of a bag-piper playing on his instrument exactly like a modern highlander. The Greeks had their Ασκαυλης, or instrument composed of a *pipe* and *blown-up skin*. The Romans, in all probability, borrowed it from them, who still use it under the names of *piva* and *cornu-musa*. The Bagpipe has been a favourite instrument of the Scots, and has two varieties: the one with long pipes, and sounded with the mouth; the other with short pipes, played on with the fingers: the first is the loudest and most ear-piercing of all music, is the genuine highland pipe, and suited well the warlike genius of that people, rouzed their courage to battle, alarmed them when secure, and collected them when scattered; solaced them in their long and painful marches, and in times of peace kept up the memory of the gallantry of their ancestors, by tunes composed after signal victories.

BAGS, in military employments, are used on many occasions: as,

Sand-Bags, generally 16 inches diameter, and 30 high, filled with earth or sand to repair breaches, and the embrasures of batteries, when damaged by the enemies fire, or by the blast of the guns. Sometimes they are made less, and placed three together, upon the parapets, for the men to fire through.

Earth-Bags, containing about a cubical foot of earth, used to raise a parapet in haste, or repair one that is beaten down. They are only used when the ground is rocky, and not affording earth to carry on the approaches.

BALL, in *the military art*, comprehends all sorts of balls and bullets for fire-arms, from the cannon to the pistol.

Cannon-Balls are of iron; musket and pistol-

piſtol-balls are of lead. Cannon-balls are always diſtinguiſhed by their reſpective calibres, thus,

A 42	pound ball, the diameter of which is	6,684 inches
32		6,105
24		5,547
18		5,040
12		4,403
9		4,000
6		3,498
3		2,775
2		2,423
1		1,923

Fire-Balls, } of which there are various *Light*-Balls, } ſorts, and for various purpoſes. Their compoſition is mealed powder 2, ſaltpetre 1½, ſulphur 1, roſin 1, turpentine 2½. Sometimes they are made of an iron ſhell, ſometimes a ſtone, filled and covered with various coats of the above compoſition, 'till of a proper ſize; letting the laſt coat be of grained powder. But the beſt ſort, in my opinion, is to take thick brown paper, and make a ſhell the ſize of the mortar, and fill it with a compoſition of an equal quantity of ſulphur, pitch, roſin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a conſiderable time.

When they are intended to ſet fire to magazines, buildings, &c. the compoſition muſt be mealed powder 10, ſaltpetre 2, ſulphur 4, and roſin 1; or rather mealed powder 48, ſaltpetre 32, ſulphur 16, roſin 4, ſteel or iron filings 2, fir-tree ſaw-duſt boiled in ſaltpetre ley 2, birch-wood charcoal 1, well rammed into a ſhell for that purpoſe, having various holes filled with ſmall barrels, loaded with muſket-balls; and laſtly the whole emerged in melted pitch, roſin and turpentine oil.

Smoke-Balls are prepared as above, with this difference, of 5 to 1 of pitch, roſin and ſaw-duſt. This compoſition is put into ſhells made for that purpoſe, having 4 holes to let out the ſmoke: they are thrown out of mortars, and continue to ſmoke from 25 to 30 minutes.

Stink-Balls are prepared by a compoſition of mealed powder, roſin, ſaltpetre, pitch, ſulphur, raſped horſes and aſſes hoofs, burnt in the fire, aſſa-fœtida, ſeraphim-gum or ferula, and bug or ſtinking herbs, made up into balls, as mentioned at *Light*-Balls, agreeable to the ſize of the mortar you intend to throw them out of.

Poiſoned-Balls. I am not ſure whether ever they have been uſed in Europe, but the Indians and Africans have always been very ingenious at poiſoning ſeveral ſorts of warlike ſtores and inſtruments. Their compoſition is mealed powder 4, pitch 6, roſin 3, ſulphur 5, aſſa-fœtida 8, extract of toads poiſon 12, other poiſonous ſubſtances 12, made into balls as above directed.

Red-hot Balls are fired out of mortars, howitzers, or cannon. Uſe which you will, the ball muſt be made red-hot, which is done upon a large coal fire in a ſquare hole made in the ground, 6 feet every way, and 4 or 5 feet deep. Some make the fire under an iron grate, on which the ſhell or ball is laid; but the beſt way is to put the ball into the middle of a clear burning fire, and when red-hot, all the fiery particles muſt be ſwept off. Whatever you uſe to throw the red-hot ball out of, muſt be elevated according to the diſtance you intend it ſhall range, and the charge of powder put into a flannel cartridge, and a good wad upon that; then a piece of wood of the exact diameter of the piece, and about 3½ inches thick, to prevent the ball from ſetting fire to the powder; then place the ball on the edge of the mortar, &c. with an inſtrument for that purpoſe, and let it roll of itſelf againſt the wood, and inſtantly fire it off. Should there be a ditch or parallel before ſuch a battery, with ſoldiers, the wood muſt not be uſed, as the blaſt of powder will break it to pieces, and its own elaſticity prevent it from flying far; it would in that caſe either kill or wound your own people. For this deficiency the wad muſt be double.

Chain-Balls are two balls linked together by a chain of 8 or 10 inches long, and I have even ſeen ſome with a chain of 3 or 4 feet long; they are uſed to deſtroy the paliſadoes, wooden bridges, and chevaux-de-friezes of a fortification. They are alſo very deſtructive to the rigging of a ſhip.

Stang-Balls are by ſome called balls of two heads; they are ſometimes made of two half-balls joined together by a bar of iron from 8 to 14 inches long; they are ſometimes made of two entire balls: they are for the ſame purpoſe as the before-mentioned.

Anchor-Balls are made in the ſame way as the light-balls, and filled with the ſame compoſition, only with this addition, that theſe are made with an iron bar of $\frac{2}{3}$ of the ball's diameter in length, and 3 or 4 inches ſquare. One half is fixed within the ball, and the other half remains without; the end of the out half is made with a grapple-hook. Very uſeful to ſet fire to wooden bridges, or any thing made of wood, or even the rigging of ſhips, &c. for the pile-end being the heavieſt, flies foremoſt, and wherever it touches, faſtens, and ſets all on fire about it.

Meſſage-

Message-Balls. See Shells.

BALLIUM, in *ancient military history*. In towns the appellation of ballium was given to a work fenced with pallisades, and sometimes masonry, covering the suburbs; but in castles it was the space immediately within the outer wall.

BAN, a sort of proclamation made at the head of a body of troops, or in the several quarters or cantonments of an army, by sound of trumpet, or beat of drum; either for observing of martial discipline, or for declaring a new officer, or punishing a soldier, or the like. At present such kind of proclamations are given out in the written orders of the day.

BANDOLEERS, in *ancient military history*, a large leathern belt worn over the right shoulder, and hanging under the left arm, to carry some kind of warlike weapon.

Bandoliers, are little wooden cases covered with leather, of which every musketeer used to wear 12 hanging on a shoulder-belt; each of them contained the charge of powder for a musket. They are now no more in use, but are still to be seen in the small-armory in the Tower.

BANDROLLS. See Camp Colours.

BANDS, properly bodies of foot, though almost out of date.

Trained-Bands. In England the militia are generally so called.

Band *of Pensioners*, a company of gentlemen so called, who attend the King's person upon all solemn occasions. They are 120 in number, and receive a yearly allowance of 100l.

Band is also the denomination of a military order in Spain, instituted by Alphonsus XI. king of Castile, for the younger sons of the nobility, who, before their admission, must serve 10 years, at least, either in the army or at war; and are bound to take up arms in defence of the Catholic faith, against the infidels.

BANQUETTE. See Fortification.

BANNERS, the ordnance-flag fixed on the fore part of the drum-major's kettle-drum carriage of the royal artillery.

BARBACAN, or *Barbican*, a watch-tower, for the purpose of descrying an enemy at a great distance: it also implies an outer defence, or sort of ancient fortification to a city or castle, used especially as a fence to the city, or walls; also an aperture made in the walls of a fortress to fire through upon the enemy. It is sometimes used to denote a fort at the entrance of a bridge, or the outlet of a city, having a double wall with towers.

BARBICANAGE, money given to the maintenance of a Barbican.

BARBE. See Barbet.

BARBETS, are peasants subject to the king of Sardinia, who abandon their dwellings, when the enemy has taken possession of them. The king forms them into bodies, who defend the Alps, being part of his dominions.

Barbet-*Battery*. See Battery.

BARM, or *Berm*. See Fortification.

BARS are of sundry sorts, as

Sweep }
Cross } Bars. See Tumbril.

Fore }
Hind } *Cross*-Bars. See Powder-Cart.
Under }

Shaft } Bars. See { Waggon.
Dowel } { Mortar Bed.

BARRACKS, or *Baracks*, are places erected for both officers and men to lodge in; they are built different ways, according to their different situations. When there is sufficient room to make a large square, surrounded with buildings, they are very convenient, because the soldiers are easily confined to their quarters, and the rooms being contiguous, orders are executed with privacy and expedition; and the soldiers have not the least connection with the inhabitants of the place, which prevents quarrels and riots. The barracks at Woolwich are 16 feet square, and 3 beds in each room to hold 6 soldiers only, which is not sufficient. They would be much better if they were 20 feet long, and 18 broad, and hold 4 beds. They are sometimes built 2 or 3 stories high.

BARRICADE. To barricade is to fortify with trees, or branches of trees, cut down for that purpose, the brushy ends towards the enemy. Carts, waggons, &c. are sometimes made use of for the same purpose, viz. to keep back both horse and foot for some time.

BARRELS, in military affairs, are of various kinds.

Fire-Barrels are of different sorts: some are mounted on wheels, filled with composition and intermixed with loaded grenades, and the outside full of sharp spikes: some are placed under ground, which have the effect of small mines: they are used to roll down a breach, to prevent the enemy's entrance.——Composition, corned powder 30 lb. Swedish pitch 12, saltpetre 6, and tallow 3.

Thundering-Barrels are for the same purpose, filled with various kinds of combustibles, intermixed with small shells, grenades, and other fireworks.——Not used now.

Powder-Barrels are about 16 inches diameter, and 30 or 32 inches long, holding 100 pounds of powder.

Budge-Barrels, hold from 40 to 60 pounds of powder: at one end is fixed a leather bag

 with

with brass nails: they are used in actual service on the batteries, to keep the powder from firing by accident, for loading the guns and mortars.

BARRIER, in *fortification*, a kind of fence composed of stakes, and transums, as overthwart rafters, erected to defend the entrance of a passage, retrenchment, or the like. In the middle of the barrier is a moveable bar of wood, which is opened and shut at pleasure. It also implies a gate made of wooden bars, about 5 feet long, perpendicular to the horizon, and kept together by two long bars going across, and another crossing diagonally: they are used to stop the cut made through the esplanade before the gate of a town.

BARRIER-*Towns*, in *military history*, are Menin, Dendermond, Ypres, Tournay, Mons, Namur, and Mastricht. These towns are garrisoned half by French or Imperial, and half by Dutch troops.

BASE, or *Basis*, in *fortification*, the exterior part or side of a polygon, or that imaginary line which is drawn from the flanked angle of a bastion to the angle opposite to it.

BASE signifies also the level line on which any work stands that is even with the ground, or other work on which it is erected. Hence the base of a parapet is the rampart.

BASE, an ancient word for the smallest cannon. See CANNON.

BASE-*Ring*. See CANNON.

BASILISK, an ancient name given to a 48 pounder. See CANNON.

BASIS, the same as BASE.

BASKETS, in *military affairs*, are simple baskets, frequently used in sieges. They are filled with earth, and placed on the parapet of the trench, or any other part. They are generally about a foot and a half in diameter at the top, and eight inches at the bottom, and a foot and a half in height; so that, being placed on the parapet, a kind of embrasures are formed at the bottom, through which the soldiers fire, without being exposed to the shot of the enemy.

BASTION. See FORTIFICATION.

BATARDEAU, in *fortification*, is a massive perpendicular pile of masonry, whose length is equal to the breadth of the ditch, inundation, or any part of a fortification where the water cannot be kept in without the raising of these sorts of works, which are described either on the capitals prolonged of the bastions or half-moons, or upon their faces. In thickness it is from 15 to 18 feet, that it may be able to withstand the violence of the enemy's batteries. Its height depends upon the depth of the ditch, and upon the height of the water that is necessary to be kept up for an inundation; but the top of the building must always be under the cover of the parapet of the covert-way, so as not to be exposed to the enemy's view. In the middle of its length is raised a massive cylindrical turret, whose height exceeds the batardeau 6 feet.

Knights of the BATH, an English military order of uncertain original. Some writers say it was instituted in the Saxon times; some will have it to have been founded by Richard II. and others by Henry IV. nor is the occasion that gave rise to their order better known. Some say it arose from the custom which formerly prevailed of bathing, before they received the golden spurs. Others say that Henry IV. being in the bath, was told by a Knight, that two widows were come to demand justice of him; when leaping out of the bath, he cried, "It was his duty to prefer the doing of justice "to his subjects to the pleasures of the bath;" and in memory of this transaction the Knights of the Bath were created. Camden however insists, that this was only the restoration of the order, which was in that prince's reign almost abolished: But however that be, the order was revived under George I. by a solemn creation of a considerable number of Knights. They wear a red ribbon, and their motto is, *Tria juncta in uno*, alluding to the three cardinal virtues which every Knight ought to possess.

BATMEN are servants hired in war time to take care of the horses belonging to the train of artillery, bakery, baggage, &c. They generally wear the king's livery during their service.

BATTALIA, in *military affairs*, implies an army or considerable detachment of troops drawn up in order of battle, or in any other proper form to attack the enemy. See BATTLE.

BATTALION, or *Batallion*, an undetermined body of infantry in regard to number, generally from 500 to 800 men. In our foot guards, the first regiment consists of 3 battalions, and the second and third of 2 each. The royal regiment of artillery consists of 4 battalions. Sometimes regiments consist of but 1 battalion; but if more numerous, are divided into several battalions, according to their strength; so that every one may come within the numbers mentioned. A battalion in one of our marching regiments consists of 603 men, officers and non-commissioned included. When there are companies of several regiments in a garrison to form a battalion, those of the eldest regiment post themselves on the right, those

those of the second on the left, and so on until the youngest fall into the centre. The officers take their posts before their companies, from the right and left, according to seniority. Each battalion is divided into 4 divisions, and each division forms 2 platoons. The companies of grenadiers being unequal in all battalions, their post should be regulated by the commanding officer. See REGIMENT.

Triangular BATTALION, in *ancient military history*, a body of troops ranged in the form of a triangle, in which the ranks exceed each other by an equal number of men: if the first rank consists of one man only, and the difference between the ranks is only one, then its form is that of an equilateral triangle; and when the difference between the ranks is more than one, its form may then be an isosceles, or scalene triangle. This method is now laid aside.

BATTERING, in *military affairs*, implies the firing with heavy artillery on some fortification or strong post possessed by an enemy, in order to demolish the works.

BATTERING-*Pieces* are large pieces of cannon, though they now never exceed a 24 pounder, used in battering a fortified town or post.

BATTERING-*Train*, a train of artillery used solely for besieging a strong place, inclusive of mortars and howitzers: all heavy 24, 18, and 12 pounders, come under this denomination; as likewise the 10 and 8-inch mortars and howitzers.

BATTERING-*Ram*. See the article RAM.

BATTERY, in *military affairs*, implies any place where cannon or mortars are mounted, either to attack the forces of the enemy, or batter a fortification: hence batteries have various names, agreeable to the purposes they are designed for.

Gun-BATTERY, is a defence made of earth faced with green sods or fascines, and sometimes made of gabions filled with earth: it consists of a *breast-work*, *parapet*, or *epaulement*, of 18 or 20 feet thick at top, and of 22 or 24 at the foundation; of a ditch 12 feet broad at the bottom, and 18 at the top, and 7 feet deep. They must be 7½ feet high. The embrasures are 2 feet wide within, and 9 without, sloping a little downwards, to depress the metal on occasion. The distance from the centre of one embrasure to that of the other is 18 feet; that is, the guns are placed at 18 feet distance from each other; consequently the *merlins* (or that part of solid earth between the embrasures) are 16 feet within, and 7 without. The *genouillieres* (or part of the parapet which covers the carriage of the gun) are generally made 2½ feet high from the platform to the opening of the embrasures; though this height ought to be regulated according to the semi-diameter of the wheels of the carriage, or the nature of the gun. The *platforms* are a kind of wooden floors, made to prevent the cannon from sinking into the ground, and to render the working of the guns more easy; and are, strictly speaking, a part of the battery. They are composed of 5 sleepers, or joists of wood, laid lengthways, the whole length of the intended platform; and to keep them firm in their places, stakes must be driven into the ground on each side: these sleepers are then covered with sound thick planks, laid parallel to the parapet; and at the lower end of the platform, next to the parapet, a piece of timber 6 inches square, called a *hurter*, is placed, to prevent the wheels from damaging the parapet. Platforms are generally made 18 feet long, 15 feet broad behind, and 9 before, with a slope of about 9 or 10 inches to prevent the guns from recoiling too much, and for bringing them more easily forward when loaded. The dimensions of the platforms, sleepers, planks, hurters, and nails, ought to be regulated according to the nature of the pieces that are to be mounted. See Plate III. fig. 1.

The powder magazines to serve the batteries ought to be at a convenient distance from the same, as also from each other; the large one, at least 55 feet in the rear of the battery, and the small ones about 25. Sometimes the large magazines are made either to the right or left of the battery, in order to deceive the enemy; to be 5 feet under ground; the sides and roof to be well secured with boards, and covered with earth, clay, or something of a similar substance, to prevent the powder from being fired: they are guarded by centinels, sword in hand. The balls are piled in readiness beside the merlins, between the embrasures.

The officers of the artillery ought always to construct their own batteries and platforms, and not the engineers, as is practised in England; for certainly none can be so good judges of those things as the artillery officers, whose daily practice it is; consequently they are the properest people to direct the situation and making of batteries on all occasions.

Mortar-BATTERY. These kinds of batteries differ from gun-batteries, only in having no embrasures. They consist in a parapet of 18 or 20 feet thick, 7½ high in front, and 6 in the rear; of a berm 2½ or 3 feet broad, according to the quality of the earth; of a ditch 24 feet broad at the top, and 20 at the bottom. The

beds

beds must be 9 feet long, 6 broad, 8 from each other, and 5 feet from the parapet: they are not to be sloping like the gun-platforms, but exactly horizontal. The insides of these batteries are sometimes sunk 2 or 3 feet into the ground, by which they are much sooner made than those of cannon. The powder magazines and piles of shells are placed as is mentioned in the art. GUN-BATTERY. See Pl. III. fig. 2.

Ricochet-BATTERY, so called by its inventor M. Vauban, and first used at the siege of Aeth in 1697. It is a method of firing with a very small quantity of powder, and a little elevation, so as just to fire over the parapet; and then the shot will roll along the opposite rampart, dismounting the cannon, and driving or destroying the troops. At a siege they are generally placed at about 300 feet before the first parallel, perpendicular to the faces produced, which they are to enfilade. Ricochet practice is not confined to cannon alone; small mortars and howitzers may effectually be used for the same purpose. They are of singular use in the day of battle, to enfilade the enemy's ranks; for when they perceive the shells rolling and bouncing about with their fuzes burning, expecting them to burst every moment, the bravest among them will hardly have courage to wait their approach and the fatal event.

Horizontal BATTERIES are such as have only a parapet and ditch; the platform being only the surface of the horizon made level.

Breach or *Sunk* BATTERIES are such as are sunk upon the glacis, with a design to make an accessible breach in the faces or salient angles of the bastion and ravelin.

Cross-BATTERIES are such as play athwart each other against the same object, forming an angle there; whence greater destruction follows, because what one shot shakes, the other beats down.

Oblique-BATTERIES, or *Batterits en Echarpé*, are those which play on any work obliquely, making an obtuse angle with the line of range, after striking the object.

Enfilading-BATTERIES are those that sweep or scour the whole length of a strait line, or the face or flank of any work.

Sweeping-BATTERIES. See *Enfilading*-BATTERIES.

Redan-BATTERIES are such as flank each other at the salient and rentrant angles of a fortification.

Direct-BATTERIES are those situated opposite the place intended to be battered, so that the balls strike the works nearly at right angles.

Reverse-BATTERIES are those which play on the rear of the troops appointed to defend the place.

Glancing-BATTERIES are such whose shot strike the object at an angle of about 20°, after which the ball glances from the object, and recoils to some adjacent parts.

Joint-BATTERIES, } when several guns fire
Comerade-BATTERIES, } on the same object at the same time. When 10 guns are fired at once, their effect will be much greater than when fired separately.

Sunk-BATTERIES are those whose platforms are sunk beneath the level of the field, the ground serving for the parapet; and in it the embrasures are made. This often happens in mortar, but seldom in gun-batteries. BATTERY sometimes signifies the guns themselves placed in a battery.

BATTERY-*Planks* are those planks or boards used in making platforms.

BATTERY-*Boxes* are square chests or boxes, filled with earth or dung; used in making batteries, where gabions and earth are not to be had. They must not be too large, but of a size that is governable.

BATTERY-*Nails* are wooden pins made of the toughest wood, with which the planks that cover the platforms are nailed. Iron nails might strike fire against the iron-work of the wheels, in recoiling, &c. and be dangerous.

Fascine-BATTERIES, } are batteries made of
Gabion-BATTERIES, } those machines, where sods are scarce, and the earth very loose or sandy.

Number of men, tools, pickets, and planks for making BATTERIES, *from 2 to 20 pieces of cannon, in one night.*

Nº. of guns	Length of the battery	Men to make the Battery	Men to make the fascines	Tools	Fascines of 10 feet	Fascines of 8 feet	Fascines of 6 feet	Pickets	Mallets	Hand-bills	Platforms: Planks	Platforms: Sleepers	Platforms: Pickets	Bavins
2	40	50	15	70	70	48	16	590	10	12	36	10	68	0
4	58	70	25	100	120	76	32	1000	18	16	72	20	128	100
6	76	90	35	130	170	104	48	1410	26	20	108	30	192	150
8	94	110	45	160	220	132	64	1820	34	24	144	40	256	200
10	112	130	55	190	270	160	80	2230	42	28	180	50	320	250
12	130	150	65	220	320	188	96	2640	50	32	216	60	384	300
14	148	170	75	250	370	216	112	3050	58	36	252	70	448	350
16	166	190	85	280	420	244	128	3460	66	40	288	80	512	400
18	184	210	95	310	470	272	144	3870	74	44	324	90	576	450
20	202	230	105	340	520	300	160	4280	82	48	360	100	640	500

Battery-*Master*, whose duty formerly it was to raise the batteries. This office is now suppressed in England.

Battering-*Pieces*, } **Battering-*Train*,** } are those guns made use of at a siege to make breaches in the works. It is judged by all nations that no less than 24 or 18 pounders are proper for that use. Formerly much larger calibres were used, but, as they were so long and heavy, became very troublesome to transport and manage; are now entirely rejected.

BATTEURS *d'Estrade*. See Scouts.

BATTLE, implies an action, where the forces of two armies are engaged; and is of two kinds, *general* and *particular*; general where the whole army is engaged, and particular where only a part is in action; but as they only differ in numbers, the methods are nearly alike.

The most remarkable on English record are the

1016. Battle of Ashdown, between Canute and Edmund.

1066. Battle of Hastings, where king Harold was slain.

1214.	Battle of	Bovines, 25 July.
1217.		Lincoln, 19 May.
1264.		Lewis, 14 May.
1265.		Evesham, 4 Aug.
1314.		Bannockburn, 25 June.
1333.		Haldon-Hill, 19 July.
1346.		Cressy, 26 Aug.

Battle of Durham, when David, king of Scots, was taken prisoner, 17 Oct.

1356. Battle of Poictiers, when the king of France and his son were taken prisoners, 19 Sept.

1388. Battle of Otterburn, between Hotspur and earl Douglas, 31 July.

1403.	Battle of	Shrewsbury, 12 July.
1415.		Agincourt, 25 Oct.
1421.		Beaugé, 3 April.
1423.		Crevant, June.
1424.		Verneuil, 27 Aug.
1429.		Herrings, 12 Feb.
1455.		St. Alban's, 22 May.
145[illegible]		Bloreheath, 23 Sept.
1460.		Northampton, 10 July.
		Wakefield, 24 Dec.
1461.		Touton, 29 March.
1464.		Hexham, 15 May.
1469.		Banbury, 26 July.
1470.		Stamford, March.
1471.		Barnet, 14 April.
		Tewkesbury, 4 May.
1485.		Bosworth, 22 Aug.

1487.	Battle of	Stoke, 6 June.
1497.		Blackheath, 22 June.

1513. Battle of Flouden, 9 Sept. when James IV. king of Scots, was killed.

1542.	Battle of	Solway, 24 Nov.
1547.		Pinkey, 10 Sept.
1557.		St. Quintin, 10 Aug.
1642.		Edgehill, 24 Oct.
1643.		Shatton, 16 May.
		Lansdown, 5 July.
		Roundaway down, 13 July
		Newbury, 20 Sept.
1644.		Marston-moor, 2 July.
1641.		Naseby, June.
1650.		Dunbar, 3 Sept.
1651.		Worcester, 3 Sept.
1679.		Bothwell-bridge, 22 June
1690.		Boyne, 1 July.
1691.		Aughrim, 22 July.
1692.		Steinkirk.
1704.		Blenheim, 13 Aug.
1706.		Ramillies, on Whitsunday
1708.		Oudenard, 30 June.
		Wynendale, 28 Sept.
1709.		Malplaquet, 11 Sept.
		Blaregnies, 14 Sept.
1715.		Dumblain, 12 Nov.
1743.		Dettingen, 26 June.
1744.		Fontenoy, 30 Apr.
1745.		Preston-pans, 21 Sept.
1746.		Falkerk, 17 Jan.
		Culloden, 16 April.
1747.		Lafeld, 20 July.
1756.		Lobositz, 1 Oct.
1757.		Rosbach, 5 Nov.
		Reichenberg, 21 April.
		Gros Jegerndorff, 30 Aug.
		Breslau, 22 Nov.
		Lissa, 5 Dec.
		Hastenbeck, 26 July.
		Kolin, 13 June.
		Prague, 6 May.
1758.		Sandershausen, 23 July.
		Crevelt, 23 June.
		Meer, 5 Aug.
		Zorndorff, 25 Aug.
		Sandershagen, 10 Oct.
		Munden, 11 Oct.
		Huchkerken, 14 Oct.
1759.		Cunnersdorf, 12 Aug.
		Bergen, 13 April.
		Zullichau, 23 July.
		Coefeld, 1 Aug.
		Minden, 1 Aug.
		Torgau, 8 Sept.
		Pretsch, 29 Oct.

1759.		Abraham, 13 Sept.
		Moxen, 20 and 21 Nov.
1760.		Cosdorff, 20 Feb.
		Quebec, 28 April.
		Grabensteyn, 4 June
		Corbach, 24 June.
		Emsdorff, 9 July.
		Warburg, 31 July.
		Strehlen, 2 Aug.
		Leignitz, 15 Aug.
	Battle of	Torgau, 2 Nov.
1761.		Langensaltze, 15 Feb.
		Grünberg, 21 March.
		Vellinghausen, 16 July.
		Kirkdenckern, 15 July.
		Finbeck, 24 Aug.
1762.		Dobeln, 12 May.
		Wilhelmstahl, 24 June.
		Fulda, 23 July.
		Friedberg, 30 Aug.
		Freyberg, 10 and 29 Oct.
1775.		Bunker's-hill, 17 June.

There is no action in war more brilliant than that of battles. Their success sometimes decides the fate of kingdoms. It is by this action a general acquires his reputation. It is in battle that his valour, his force of genius, and his prudence, appear in their full extent; and where especially he has occasion for that firmness of mind, without which the most able general will hardly succeed.

Battles have ever been the last resource of good generals. A situation where chance and accident often baffle and overcome the most prudential and most able arrangements, and where superiority in numbers by no means ensures success, is such as is never entered into without a clear necessity for so doing. The fighting a battle only because the enemy is near, or from having no other formed plan of offence, is a direful way of making war. Darius lost his crown and life by it: king Harold, of England, did the same; and Francis I. at Pavia, lost the battle and his liberty. King John, of France, fought the battle of Poictiers, though ruin attended his enemy if he had not fought.

The true situation for giving battle is when an army's situation cannot be worse, if defeated, than if it does not fight at all; and when the advantage may be great, and the loss little. Such was the duke of Cumberland's at Hastenbeck, in 1757, and prince Ferdinand's at Vellinghausen, in 1761. The reasons and situations for giving battle are so numerous, that to treat of them all would fill a large volume: I will therefore content myself with the following. There may be exigencies of state that require its army to attack the enemy at all events. Such were the causes of the battle of Blenheim, in 1704, of Zorndorff, in 1758, of Cunnersdorff, in 1759, and of Rosbach, in 1757. To raise a siege, to defend or cover a country. An army is also obliged to engage when shut up in a post. An army may give battle to effectuate its junction with another army, &c.

The preparations for battle admit of infinite variety. By a knowledge of the detail of battles, the precept will accompany the example. The main general preparations are, to profit by any advantage of ground; that the tactical form of the army be in some measure adapted to it; and that such form be, if possible, a form tactically better than the enemy's; and, in forming the army, to have a most careful attention to multiply resources, so that the fate of the army may not hang on one or two efforts; to give any particular part of the army, whose quality is superior to such part in the enemy's army, a position that ensures action; and, finally, to have a rear by nature, or if possible, by art, capable of checking the enemy in case of defeat.

The dispositions of battles admit likewise of an infinite variety of cases; for even the difference of ground which happens at almost every step, gives occasion to change the disposition or plan; and a general's experience will teach him to profit by this, and take the advantage the ground offers him. It is an instant, a *coup-d'œil*, which decides this: for it is to be feared the enemy may deprive you of those advantages, or turn them to his own profit; and for that reason this admits of no precise rule, the whole depending on the time and the occasion.

With regard to battles there are three things to be considered; what precedes, what accompanies, and what follows the action. As to what precedes the action, you should unite all your force, examine the advantage of the ground, the wind, and the sun, (things not to be neglected) and chuse, if possible, a field of battle proportioned to the number of your troops.

You must post the different kinds of troops advantageously for each: they must be so disposed as to be able to return often to the charge; for he who can charge often with fresh troops, is commonly victorious. Your wings must be covered so as not to be surrounded, and you must observe, that your troops can assist each other without any confusion, the intervals being

being proportioned to the battalions and ſquadrons.

Great care muſt be taken about the regulation of the artillery, which ſhould be diſpoſed ſo as to be able to act in every place to the greateſt advantage; for nothing is more certain than that, if the artillery be well commanded, properly diſtributed, and manfully ſerved, it will greatly contribute to gaining the battle; being looked upon as the general inſtrument of the army, and the moſt eſſential part of military force. The artillery muſt be well ſupplied with ammunition, and each ſoldier have a ſufficient number of cartridges. The baggage, proviſions, and treaſure of the army, ſhould, on the day of battle, be ſent to a place of ſafety.

In battle, where the attacks are, there is alſo the principal defence. If an army attacks, it forms at pleaſure; it makes its points at will: if it defends, it will be ſometimes difficult to penetrate into the deſigns of the enemy, but when once found, ſuccour ſucceeds to the diſcovery. Ground and numbers muſt ever lead in the arrangement of battles; impreſſion and reſource will ever bid faireſt for winning them.

Battle-*Array*, } the method and order of *Line of* Battle, } arranging the troops in order or line of battle; the form of drawing up the army for an engagement. This method generally conſiſts of three lines, viz. the front line, the rear line, and the reſerve.

The ſecond line ſhould be about 300 paces behind the firſt, and the reſerve at about 5 or 600 paces behind the ſecond. The artillery is likewiſe divided along the front of the firſt line. The front line ſhould be ſtronger than the rear line, that its ſhock may be more violent, and that, by having a greater front, it may more eaſily cloſe on the enemy's flanks. If the firſt line has the advantage, it ſhould continue to act, and attack the enemy's ſecond line, terrified by the defeat of their firſt. The artillery muſt always accompany the line of battle in the order it was at firſt diſtributed, if the ground permit it; and the reſt of the army ſhould follow the motions of the firſt line, when it continues to march on after its firſt ſucceſs.

Battle-*Ax*, an offenſive weapon, formerly much uſed by the Danes, and other northern infantry. It was a kind of halbert, and did great execution when wielded by a ſtrong arm.

Main-Battle. See Battle-*Array*.

BAVINS, in military affairs, implies ſmall faggots, made of bruſh-wood, of a conſiderable length, no part of the bruſh being taken off. See Fascines.

BAYONET, a kind of ſhort hollow dagger, made with a hollow handle, and a ſhoulder, to fix on the muzzle of a firelock or muſket, ſo that neither the charging nor firing is prevented by its being fixed on the piece; and is of infinite ſervice againſt the horſe. At firſt the bayonet was ſcrewed into the muzzle of the barrel, conſequently could not be uſed during the fire. It is ſaid to have been invented by the people of Malacca, and firſt made uſe of on quitting the pikes.

BEAT, in a *military ſenſe*, ſignifies to gain the day, to win the battle, &c.

To Beat *a parley*. See Chamade.

To Beat *a drum*. See Drum.

BEDS, in the military language, are of various ſorts, viz.

Mortar-Beds ſerve for the ſame purpoſe as a carriage does to a cannon: they are made of ſolid timber, conſiſting generally of 2 pieces faſtened together with ſtrong iron bolts and bars. Their ſizes are according to the kind of mortar they carry, and their various dimenſions are ſpecified in the following table. See Plate IV.

Bore		13	10	8	5.8	4.6
Lower bed	length	84.	66.	50.	..	..
	breadth	33.	20.	..	..	..
	height	13.	10.	9.		
Upper bed	length	83.	65.	49.	31.5	28.5
	breadth	32.	25.	19.	16.	14.
	height	13.	12.	11.	10.	9.
Breadth of quarter round		3.	2.5	2.5		
——— of the ogee and fillet		4.	3.5	3.		
Length of the cavity		20.	16.	12.	8.	5.7
Trunnion-hole from fore end		31.	20.	15.5	13.3	11.7
Diameter of trunnion-holes		7.2	6.4	5.4	3.4	2.4
Depth of trunnion-holes		7.	6.	5.	3.2	3.2

N. B. Theſe are the dimenſions of the preſent land mortars. The column at top contains the diameter of each mortar, expreſſed in inches; the other columns are likewiſe inches and decimals. The diſtance of the trunnion-holes is meaſured from the quarter round, and not from the end of the bed. Vid. plate I.

E

Names and number of iron-work in a 13, 10, and 8-inch mortar-bed.

Cap-squares	2	End riveting-plates	2
Eye-bolts	2	Middle plate	1
Joint-bolts	2	Riveting-bolts	6
Under and upper bed-bolts	9	Square riveting-plates	12
Dowel-bars	4	Traversing-bolts	6
Rings with bolts	4	Keys, chains and staples	2
Reverse-bars	2		

Names and number of iron-work in a royal and cochorn mortar-bed. Vid. plate IV. fig. 1 and 2.

Cap-squares	2	Handles with starts	2
Eye-bolts	2	Square riveting-plates	5
Joint-bolts	2		
Riveting-bolt and ring	1	Keys, chains and staples	2

Royal-Beds, *Cochorn*-Beds, are carriages for a royal mortar, whose diameter is 5.8 inches; and a cochorn mortar, whose diameter is 4.6 inches, as mentioned in the preceding table. Those beds are made of one solid block only. Plate IV.

Sea-Mortar-Beds, are likewise made of solid timber, like the former, but differ in their form, having a hole in the centre to receive the pintle or strong iron bolt, about which the bed turns. Sea-mortars are mounted on these beds, on board of the bomb-ketches. See Plate V.

Dimensions of the present Sea-Mortar-beds.

	13	10
Diameter of the bore	13	10
Length of the bed	94.	84.
Breadth of the bed	54.	17.
Height of the bed	27.	23.
Pintle-hole from the fore end	39.	32.
Diameter of the pintle-hole	6. 5	6. 5
Trunnions from the fore end	46.	42. 5
Diameter of the trunnion-holes	10.	8.
Depth of the trunnion-holes	8.	5.
Diameter of the circular bed	59.	59.
Height of the circular bed	8.	6.
Distance to the bed-bolster	15.	10.
Depth of the cavity	15.	12.
Its opening above	30.	21.
Bed bolster length	53.	14.
Length below	29.	2. 1
Its height	16.	17.
Its breadth	14.	12.

N. B. These beds are placed upon very strong timber frames, fixed into the bomb-ketch, in which the pintle is fixed, so as the bed may turn about it, to fire any way. The fore part of these beds is an arc of a circle described from the same centre as the pintle-hole. The plans, elevations, and sections, shew in a distant manner the several parts of these beds. See Plate V.

Names and quantity of iron-work in sea-mortar-beds.

Cap-squares	2	Cross bed-bolts	7
Eye-bolts	6	Down bed-bolts	15
Loop-bolts	4	Bed bolster-plates	2
Traversing-bolts	4	Keys, chains, and staples	6
Middle-plate	1		
Riveting-plates	2	Nails to the bed-bolster bed	4
Riveting-bolts	6		
Square riveting-plates for ditto	7	Bed-bolster rings and loops	4

Stool-Bed, is a piece of wood on which the breech of a gun rests upon a truck-carriage, with another piece fixed to it at the hind end, that rests upon the body of the hind axle-tree; and the fore part is supported by an iron bolt. See Carriage.

Bed-*Bolts*.
Bed-*Bolsters*.
Stool Bed-*Bolts*.
See Carriages and Beds.

BEETLES, in a *military sense*, are large wooden hammers for driving down palisades, and for other uses, &c.

BELLS *of Arms*. See Arms.

BELTS, in a *military sense*, are of several sorts; as

Sword-Belts, a well-known machine, in which the sword hangs.

Shoulder-Belts, a broad leather belt, which goes over the shoulder, and to which the pouch fixed. They should be made of stout smooth buff, about 3 inches broad, with two buckles to fix the pouch to the belt. See Pouch.

BERM, in *fortification*, is a little space or path, of about 4, 6, or 8 feet broad, according to the height and breadth of the works, between the ditch and the parapet, when made of turf, to prevent the earth from rolling into the ditch; and serves likewise to pass and repass.

BESIEGERS, the army that lays siege to a fortified place.

BESIEGED, the garrison that defends the place against the army that lays siege to it. See Siege.

BILLET, a well-known ticket for quartering soldiers.

Billeting, in the *army*, implies the quartering soldiers in the houses of any town or village; which billet intitles each soldier, by act of parliament, to candles, vinegar, salt, and either small-beer or cyder, not exceeding 5 pints for each man per day, gratis; with the use of fire, and the necessary utensils for dressing and eating their meat: but, provided the landlord agrees to board them, they are to pay as follows:

Each

Each officer of horſe, under the degree of a captain, per diem, 2s.

Each officer of dragoons, under the degree of a captain, 1s 6d.

Each officer of foot, under the degree of a captain, 1s. and with a horſe, 6d. more.

Each light-horſeman or dragoon, with horſe, 1s.

Each foot ſoldier, 4d.

BIOVAC, in *military affairs*, ſignifies a guard at night, performed by the whole army, which either at a ſiege, or encamped before an enemy, turn out of their tents under arms, and continue ſo all night, to prevent a ſurpriſe. When troops are very much harraſſed, or the dread of the enemy is not great, the two front ranks only remain under arms, whilſt the rear ranks reſt by their arms on the ground; and ſo alternately

BLAST, and BLASTING. See Mines and Mining.

BLINDS, in *military affairs*, are wooden frames, compoſed of 4 pieces, either flat or round, two of which are 6 feet long, and the others 3 or 4 feet, which ſerve as ſpars to faſten the two firſt together: the longeſt are pointed at both ends, and the two others are faſtened towards the extremities of the former, at about 10 or 12 inches from their points, the whole forming a rectangular parallelogram, the long ſides of which project beyond the other about 10 or 12 inches. Their uſe is to fix them either upright, or in a vertical poſition, againſt the ſides of the trenches or ſaps, to ſuſtain the earth. Their points at the bottom ſerve to fix them in the earth, and thoſe at top to hold the faſcines that are placed upon them, ſo that the ſap or trench is formed into a kind of covered gallery, to ſecure the troops from ſtones and grenades.

The term *Blind* is alſo uſed to expreſs a kind of hurdle, made of the branches of trees, behind which the ſoldiers, miners, or labourers, may carry on their work without being ſeen. See Hurdle.

Blinds, are ſometimes only canvas ſtretched to take away the ſight of the enemy. Sometimes they are planks ſet up, for which ſee Mantlet. Sometimes they are made of a kind of coarſe baſket-work. See Gabions. Sometimes of barrels, or ſacks filled with earth. In ſhort, they ſignify any thing that covers the labourers from the enemy.

Blind. See Orillon and Fortification.

BLOCKADE, BLOCKADING, } in *military affairs*, implies the ſurrounding a place with different bodies of troops, who ſhut up all the avenues on every ſide, and prevent every thing from going in or out of the place. The deſign of the blockade is to oblige thoſe who are ſhut up in the town to conſume all their proviſions, and by that means to compel them to ſurrender for want of ſubſiſtance.

Hence it appears that a blockade muſt laſt a long time, when a place is well provided with neceſſaries; for which reaſon this method of reducing a town is ſeldom taken, but when there is reaſon to believe the magazines are unprovided, or ſometimes when the nature or ſituation of the place permits not the approaches to be made, which are neceſſary to attack it in the uſual way.

Maritime towns, which have a port, are in much the ſame caſe as other towns, when their port can be blocked up, and the beſiegers are maſters of the ſea, and can prevent ſuccours from being conveyed that way into the place.

To Blockade, or to block up a place, is to ſhut up all the avenues, ſo that it can receive no relief either of men or proviſions, &c.

To raiſe a Blockade, is to march from before the place, and leave it free and open as before.

To turn a ſiege into a Blockade, is to deſiſt from a regular method of beſieging, and to ſurround the place with thoſe troops who had formed the ſiege.

To form a Blockade, is to ſurround the place with troops, and hinder any thing from going either in or out.

BLUNDERBUSS, a well-known fire-arm, conſiſting of a wide, ſhort, but very large bore, capable of holding a number of muſket or piſtol balls, very fit for doing great execution in a croud, to make good a narrow paſſage, door of a houſe, ſtair-caſe; or in boarding a ſhip.

BOARD *of Ordnance*. See Ordnance.

Board, alſo implies an office under the government, where the affairs of ſome department are tranſacted; of which there are ſeveral ſorts in England.

BODY, in *the art of war*, is a number of forces, horſe or foot, united and marching under one commander.

Main Body *of an army*, ſometimes means the troops encamped in the centre between the two wings, and generally infantry. The main body on a march, ſignifies the whole of the army, excluſive of the van and rear-guard.

Body *of Reſerve*. See Reserve.

Body *of a place*, is, generally ſpeaking, the buildings in a fortified town; yet the incloſure round them is generally underſtood by it.

BOLSTERS.

BOLSTERS. See WAGGONS.

BOLTS, in *gunnery*, are of feveral forts: as,

1. *Eye* 2. *Joint* 3. *Tranfom* 4. *Bed* 5. *Breeching* 6. *Bracket* 7. *Stool-bed* 8. *Garnifh* 9. *Axle-tree* 10. *Bolfter*	BOLTS.	See CARRIAGE.

BOMB { See SHELL. *Cheft*. See CAISSON. *Veffels* } *Ketches* } fmall veffels, made very ftrong with large beams, particularly calculated for throwing fhells into a town, caftle, or fortification, from 13 and 10-inch mortars; two of which are placed on board of each fhip. They are faid to have been invented by one M. Reyneau, a Frenchman, and to have been firft put in action at the bombardment of Algiers in 1681: 'till then it had been judged impracticable to bombard a place from the fea.

BOMBARD, an ancient piece of ordnance fo called, very fhort, and very thick, with an uncommon large bore. There have been bombards which have thrown a ball or fhell of 300 weight: they made ufe of cranes to load them. The Turks ufe fome of them at prefent.

BOMBARDIERS, artillery foldiers, fo called becaufe they are always employed in mortar and howitzer duty. They are to load them on all occafions; and in moft fervices they load the fhells and grenades, fix the fuzes, prepare the compofition both for fuzes and tubes, and fire both mortars and howitzers on every occafion. In the Englifh fervice, fhells and grenades, compofition for the fame, fuzes, &c. are prepared in the laboratory by people well fkilled in that bufinefs.

In moft foreign fervices both officers and foldiers belonging to the companies of bombardiers have an extrordinary pay, as it requires more mathematical learning to throw fhells with fome degree of exactnefs, than is requifite for the reft of the artillery. See ARTILLERY REGIMENT.

To BOMBARD, BOMBARDING, BOMBARDMENT, } the act of affaulting a city or fortrefs, by throwing fhells into it, in order to fet fire to, and ruin the houfes, churches, magazines, &c. and to do other mifchief. As one of the effects of the fhell refults from its weight, it is never difcharged as a ball from a cannon, that is, by pointing it at a certain object: but the mortars in England are fixed at an elevation of 45 degrees; that is, inclined fo many degrees from the horizon, that the fhell defcribes a curve, called the military projectile: hence a mortar, whofe trunnions are placed at the breech, can have no point-blank range. I am of opinion that mortars fhould be fo contrived, that they may be elevated to any degree required, as much preferable to thofe fixed at an angle of 45°. becaufe fhells fhould never be thrown at that angle but in one fingle cafe only, which feldom happens; that is, when the battery is fo far off, that they cannot otherwife reach the works: for when fhells are thrown from the trenches into the works of a fortification, or from the town into the trenches, they fhould have as little elevation as poffible, in order to roll along, and not bury themfelves; whereby the damage they do, and the terror they caufe to the troops, is much greater than if they fink into the ground. On the contrary, when fhells are thrown upon magazines, or any other buildings, with an intention to deftroy them, the mortar fhould be elevated as high as poffible, that the fhells may acquire a greater force in their fall.

Shells fhould be loaded with no more powder than is requifite to burft them into the greateft number of pieces, and the length of the fuzes fhould be exactly calculated according to the required ranges; for, fhould the fuze fet fire to the powder in the fhell before it falls on the place intended, the fhell will burft in the air, and probably do more mifchief to thofe who fired the mortar, than to thofe againft whom it was difcharged. To prevent this, the fuzes are divided into as many feconds as the greateft range requires, confequently may be cut to any diftance, at an elevation of 45 degrees.

Mortars are not to be fired with two fires; for when the fuze is properly fixed, and both fuze and fhell dredged with mealed powder, the blaft of the powder in the chamber of the mortar, when inflamed by the tube, will likewife fet fire to the fuze in the fhell.

The following table of loaded-fhells experiments, was the medium of three different trials, out of the different mortars mentioned, at the Pruffian camp near Meyfen, in 1761.

TABLE *of* LOADED-SHELLS EXPERIMENTS.

Nature of land-mortars.	Powder in the chamber.		Weight of the mortar.			Strokes to drive the fuze.	Weight of the shell fixed.		Weight of powder the shell contains.		Quantity of powder used.		Time of flight.	Elevation.		Remarks.
Inch.	lb.	oz.	c.	qr.	lb.	N°.	lb.	oz.	lb.	oz.	lb.	oz.	"	°	'	
13	4	8	24	2	1	21	194	,,	9	4½	8	—	16	30	30	broke in 18 pieces
,,	3	,,	,,	,,	,,	,,	192½	,,	,,	,,	7	8	19	45	—	do. 20 do.
10	3	5	10	2	11	18	90	—	4	14¾	4	6	12	35	15	do. 13 do.
,,	2	,,	,,	,,	,,	,,	89	5	,,	,,	3	12	14	38	30	do. 22 do.
Royal	—	10	—	2	18	12	16	—	1	2	1	—	10	28	25	do. 8 do.
,,	—	12	—	,,	,,	,,	15	12	,,	,,	—	14	13	40	—	do. 19 do.
Coeh.	—	5	—	2	28	,,	8	4	—	8	—	7	12	30	—	do. 6 do.
,,	—	6	—	,,	,,	10	8	5	—	,,	—	6	14	38	30	do. 12 do.

BONNETS, in *fortification*, implies a ſmall but uſeful work, that greatly annoys the enemy in their lodgments: is a work conſiſting of 2 faces, which make a ſalient angle in the nature of a ravelin, without any ditch, having only a parapet 3 feet high, and 10 or 12 feet broad. They are made at the ſalient angles of the glacis, outworks, and body of the place, beyond the counterſcarp, and in the fauſſebray. See FORTIFICATION.

BONNETS *à Prêtres*, or *Prieſt's-cap*, in *fortification*, is an outwork, having three ſalient and two inward angles, and differs from the double tenaille only in having its ſides incline inwards towards the gorge, and thoſe of a double tenaille are parallel to each other. See FORTIFICATION.

BORDER, in *military drawings*, implies ſingle or double lines, or any other ornament, round a drawing, &c.

BOOKS, *military*, the compoſition of military gentlemen of experience, genius, and learning, in order to communicate the various branches of the art of war to the public, and to poſterity. It is certain that books are one of the chief inſtruments of acquiring knowledge. They are the repoſitories of the military ſciences, and the vehicles of learning of every kind. As ſuch, I will put down a few of the beſt military books in the Engliſh, German, Dutch, and French languages.

Some of the beſt BOOKS *of artillery and gunnery in Engliſh.*

Robin's Gunnery, &c. 2 vol. 8vo. 1761.

Muller's Treatiſe of Artillery, 8vo. 1768.

Muller's Appendix to the treatiſe of Artillery, 8vo. 1768.

Williams's Theory and Practice of Gunnery, 8vo. 1766.

Simpſon's Theory of Gunnery, 8vo. 1758.

Hollyday's Practical Gunnery, 12mo. 1766.

Gray's Gunnery, 8vo. 1731.

Ardeſoif's Marine Fortification and Gunnery, 8vo. 1772.

Euler's Gunnery, by Mr. Brown, 4to. 1777.

In German.

Struenſee Anfangsgründe der Artillerie, 8vo. 1769.

Eulers erlaüterte Artillerie, 8vo. 1756.

Birnbaums Unterricht für einen Artilleriſten, 4to. 1752.

Buchner's Theoria & Praxis Artilleriæ (in German) 3 vol. folio, printed in 1682, 1683, and 1685 (*).

Dilichius Peribologia (in German) folio, 1640 (†).

In French.

Nouveau Cours de Mathématique, à l'uſage de l'Artillerie, par Belidor, 4to. 1758.

Théorie nouvelle ſur le Méchaniſme de l'Artillerie, par du Lacq, 4to. 1751.

Mémoires de l'Artillerie, par St. Remy, 3 vol. 4to. 1745.

Traité de l'Artillerie, par le Blond, 3 vol. 8vo. 1743.

Obſervations ſur le Canon, 4to. 1772.

Eſſai ſur l'uſage de l'Artillerie, 8vo. 1771.

Examen

(*) This valuable book, on account of its being printed at three different places, and of three different dates, is become exceeding ſcarce even in Germany.

(†) This was probably the firſt printed book of artillery, and is ſeldom met with.

Examen de la Poudre, traduit de l'Italien par Flavigny, 8vo. 1773.

Some of the best BOOKS *of fortification in English.*

Riou's Elements of Fortification, 4to, 1746. vol. I. *The 2d was never published.*

Muller's Theory and Practice of Fortification, 2 vol. 8vo. 1764.

Horneck's Remarks on Modern Fortification, 4to. 1758.

Coehorn's Fortification, tranflated by Saverey, folio, 1708.

In German and Dutch.

Speckle, Architectur von Feftungen, folio, 1592. Sec. Edit. 1608 (*).

Dögen's Niederlandifhe Fortification, folio, 1648.

Celarius vollkommener Feftungfbau, folio, 1656.

Freytag's Fortification, folio, 1665.

Scheiters neuer Feftungfbau, folio, 1672.

Gründels neu erfundene Fortification, folio, 1673.

Sturms gründliche Anleitung zur Kriegfbaukunft, 3 vol. 4to. 1755.

Bellerfheim irregulaire Feftungen, 4to. 1765.

Hahns Kriegs-bau-kunft, 8vo. 1775.

Humberts Kriegs-kunft, 8vo. 1756.

Zuckows Kriegs Baukunft, 4to. Frankf. 1769.

Coehorn's nieuwe Vefting-bouw, folio, 1685.

——— Verftarkinge des vyf-hooks, folio, 1682.

Coehorn's Wederleginge des Architectura militaris, folio, 1683.

In French, Spanish, and Italian.

Piedro de Navaro, Fortificatione; *fuppofed to be the first printed book of fortification; without date.*

Francifco Jeorg Senenfis, Fortificazione; *no date.*

Gerolamo Maggi, del Fortificazione, folio, 1559.

Francifco de Marchi, Fortificazione, 3 vol. grandos, Roma, 1546 (†).

Pietro Paola Floriani, Fortificazione, folio, 1654.

Pietro Sardi, Corona Imperiale del l'Architecture milit. 1677.

Les Fortifications, par De Ville, 4to. 1666.

Les Fortifications, par M. Pagan, folio, 1663.

Architecture militaire, par un Officier de Diftinction, 2 vol. 4to. 1741.

Vauban véritable Manière de fortifier, par du Fay, 2 vol. 4to. 1757.

Effai fur la Fortification, 8vo. 1755.

Some of the best BOOKS *on the art of war, in English.*

Muller's Attack and Defence of fortified places, 8vo. 1769.

Muller's Field Engineer, from Clairac, 8vo. 1760.

Bell, on Military firft Principles, 8vo. 1770.

Elementary Principles of Tactics, 8vo. 1771.

Dalrymple's Military Effays, 8vo. 1761.

Bigg's Military Hiftory, from 1739 to 1748, 8vo. 1756.

Pleydel's Effay on Field Fortification, 8vo. 1768.

Entick's Hiftory of the late War, 5 vol. 8vo. 1766.

La Cointe's Science of Military Pofts, 8vo. 1761.

Military Inftructions for Officers detached in the Field, 1770.

Le Blond's Military Engineer, 2 vol. 8vo. 1759.

Mac Intire's Treatife of the Marine Forces, 8vo. 1763.

Jones on Artificial Fireworks, 8vo. 1768.

Treatife of the late Wars in the Netherlands, 8vo. 1759.

Simes's Military Works, 3 vol. 8vo. 1772.

Lloyd's Hiftory of the late Wars, 1 vol. 4to. 1772. *The 2d was never publifhed.*

Turpin's Art of War, by Otway, 2 vol. 4to. 1761.

In German.

Frederici anleitung zur Kriegs-Wiffenfchaft, 8vo. 1763.

Genies practifche Kriegs-kunft, 8vo. 1760.

Von Lohens Soldat, oder Abhandlung vom Kriegs-ftande, 8vo. 1752.

Hiftorie des Kriegs, 6 vol. 8vo. 1758-1762.

Königs von Preuffen Unterricht von der Kriegs-kunft an Seine Generals, 8vo. 1761.

Tölner Bildung eines jungen Officiers, 8vo. 1763.

Fäfh groffe Meifter in der Kriegs-kunft, 8vo. 1764.

Jeney der Parteygänger, 8vo. 1766.

Tielke's Feld-Ingenieur, 8vo. Leipz. 1774.

Tielkes

(*) Is very fcarce, and very valuable, both the editions.

(†) This is the firft printed book of fortification with a date, and fuppofed to be even the very firft. Hiftory informs us that there are only 3 or 4 copies in being; 1 in the king of Pruffia's library, 1 or 2 in Italy, and 1 in the poffeffion of Colonel Pattifon, of the royal artillery.

Tielkes Kriegs-kunſt, 4to. Freyb. 1776.

Guiberts Verſuch über die Tactik, 2 vol. 8vo. Dreſd. 1774.

In French.

Art de Guerre, par Principes, & par Règles, par Puiſegur, 2 vol. folio, 1749.

Attaque & la Défenſe des Places, par Vauban, 2 vol. 4to. 1742.

Hiſtoire militaire du Prince Eugene, du Duc de Marlborough, & du Prince d'Orange, par Dumond & Rouſet, 2 vol. folio. 1747.

Petit Guerre, par Grand-Maiſon, 2 vol. 8vo. 1756.

L'Ecole de Mars, par de Guignard, 4to. 1758.

Hiſtoire générale des Guerres, arrivées dans le monde de depuis le Déluge, juſques en 1748, 2 vol. 4to. 1756.

Hiſtoire de Polybe, par M. de Folard, 6 vol. 4to. 1729.

Traité général des Subſiſtances militaires, 2 vol. 4to. 1744.

Traité de la Guerre dernière en Allemagne, 6 vol. 8vo. 1763.

Mémoires de Montecuculi, 2 tom. 8vo. 1758.

Mémoires militaires du Duc de Luxemburg, 6 tom. 4to. 1756.

Guibert, Eſſai général de Tactique, 4to. Lond. 1772.

BOOM, in *marine fortification*, is a long piece of timber, with which rivers or harbours are ſtopped, to prevent the enemy's coming in: it is ſometimes done by a cable or chain, and floated with yards, top-maſts, or ſpars of wood laſhed to it.

BORE, in *gunnery*, implies the cavity of the barrel of a gun, mortar, howitzer, or any other piece of ordnance. &c. CANNON.

BOW, an ancient weapon of offence, made of ſteel, wood, or other elaſtic matter; which, after being bent by means of a ſtring faſtened to its two ends, in returning to its natural ſtate, throws out an arrow with prodigious force.

The uſe of the bow is, without all doubt, of the earlieſt antiquity. It has likewiſe been the moſt univerſal of all weapons, having obtained amongſt the moſt barbarous and remote people, who had the leaſt communication with the reſt of mankind.

The bow is a weapon of offence amongſt the inhabitants of Aſia, Africa, and America, at this day; and in Europe, before the invention of fire-arms, a part of the infantry was armed with bows. Lewis XII. firſt aboliſhed the uſe of them in France, introducing, in their ſtead, the halbert, pike, and broad ſword. The long-bow was formerly in great uſe in England, and many laws were made to encourage the uſe of it. The parliament under Henry VII. complained of the diſuſe of long-bows, heretofore the ſafeguard and defence of this kingdom, and the dread and terror of its enemies.

Croſs-Bow, is likewiſe an ancient weapon of offence, of the eleventh century. Philip II. ſurnamed the Conqueror, introduced croſs-bows into France. In this reign Richard I. of England, was killed by a croſs-bow at the ſiege of Chalus.

BOXES, in *military affairs*, are of ſeveral ſorts, and for various purpoſes.

Nave-Boxes, are made of iron, and faſtened one at each end of the nave, to prevent the arms of the axle-tree, about which the boxes turn, from cauſing too much friction.

Wood-Boxes, with lids, for holding grape-ſhot, &c. each calibre has its own, diſtinguiſhed by marks of the calibre on the lid.

Tin-Boxes, ſuch as are filled with ſmall ſhot for grape, according to the ſize of the gun they are to be fired out of.

BOYAU, in *fortification*, is a particular trench ſeparated from the others, which, in winding about, incloſes different ſpaces of ground, and runs parallel with the works of the place, that it may be enfiladed. When two attacks are made at once, one near to the other, the boyau makes a communication between the trenches, and ſerves as a line of contravallation, not only to hinder the ſallies of the beſieged, but likewiſe to ſecure the miners.

BRACES, in a *military ſenſe*, ſignifies a kind of armour for the arm; they were formerly a part of a coat-of-mail.

BRACKETS, in *gunnery*, are the cheeks of the travelling carriage of a mortar; they are made of ſtrong wooden planks. This name is alſo given to that part of a large mortar-bed, where the trunnions are placed, for the elevation of the mortar: they are ſometimes made of wood, and more frequently of iron, of almoſt a ſemicircular figure, well faſtened with nails and ſtrong plates.

BRANCH. See GALLERY.

BREACH, in *fortification*, a gap, or opening, in any part of the works of a fortified place, made by the artillery or mines of the beſiegers, preparatory to the making an aſſault.

To repair a BREACH, is to ſtop or fill up the gap with gabions, faſcines, &c. and prevent the aſſault.

To fortify a BREACH, is to render it inacceſſible with chevaux-de-frize, crow's-feet, &c.

To make a lodgment in the Breach. After the besieged are driven away, the besiegers secure themselves against any future attack in the breach.

To clear the Breach, that is, to remove the ruins, that it may be the better defended.

To Break *ground*, to begin to open and work at the trenches in a siege, &c.

BREAST-PLATE, in *military antiquity*, a piece of defensive armour worn on the breast of both men and horses. They are but seldom used now.

Breast *work*. See Parapet.

BREECH *of a gun*, the end near the vent. See Cannon.

BRICKS, in *military architecture*, supply the place of stone in common buildings, and are composed of an earthy matter, hardened by art, to a resemblance of that kind: they may be very well considered as artificial stone. Bricks are of very great antiquity, as appears from sacred history, the tower of Babel being built with them; and it is said the remains are still visible. The Greeks and Romans, &c. generally used bricks in their buildings, witness the Pantheon, &c. In the east they baked their bricks in the sun. The Romans used them unburnt, having first left them to dry in the air for 3, 4, or 5 years.

The best *bricks* must not be made of any earth that is full of sand or gravel, nor of such as is gritty or stony; but of a greyish marl, or whitish chalky clay, or at least of reddish earth. But if there is a necessity to use that which is sandy, choice should be made of that which is tough and strong.

The best season for making *bricks* is the spring; because they will be subject to crack, and be full of chinks, if made in the summer: the loam should be well steeped or soaked, and wrought with water. They are shaped in a mould, and, after some drying in the sun or air, are burnt to a hardness. This is our manner of making bricks; but whether they were always made in this manner admits a doubt. We are not clear what was the use of straw in the bricks for building in Egypt, or why in some part of Germany they mix saw-dust in their clay for bricks.

We are in general tied down by custom to one form, and one size; which is truly ridiculous: 8 or 9 inches in length, and 4 in breadth, is our general measure: but beyond doubt there might be other forms, and other sizes, introduced very advantageously.

Compass Bricks, are of a circular form; their use is for steening of walls: we have also concave, and semi-cylindrical, used for different purposes.

Grey-Stocks, are make of the purest earth, and better wrought: they are used in front in building, being the strongest and handsomest of this kind.

Place-Bricks, are made of the same earth, or worse, with a mixture of dirt from the streets, and being carelessly put out of hand, are therefore weaker and more brittle, and are only used out of sight, and where little stress is laid on them.

Red-Stocks, are made of a particular earth, well wrought, and little injured by mixtures: they are used in fine work, and ornaments.

Hedgerie-Bricks, are made of a yellowish coloured loam, very hard to the touch, containing a great quantity of sand: their particular excellence is, that they will bear the greatest violence of fire without hurt.

BRIDGES, in *military affairs*, are of several sorts and denominations, viz.

Rush-Bridges, are made of large bundles of rushes, bound fast together, over which planks are laid, and fastened: these are put in marshy places, for the army to pass over on any emergency.

Pendant or *hanging* Bridges, are those not supported by posts, pillars, or batments, but hung at large in the air, sustained only at the two ends.

Draw-Bridge, that which is fastened with hinges at one end only, so that the other may be drawn up; in which case the bridge is almost perpendicular, to hinder the passage of a ditch, &c. There are others made to draw back and hinder the passage; and some that are open in the middle, one half of which turns away to one side, and the other half to the other, and both again joined at pleasure.

Flying Bridge, is generally made of two small bridges, laid one over the other, in such a manner that the uppermost stretches, and runs out, by the help of certain cords running through pullies placed along the sides of the upper bridge, which push it forwards, 'till the end of it joins the place it is intended to be fixed on. They are frequently used to surprise works, or out-posts that have but narrow ditches.

Bridge *of boats*, is a number of common boats joined parallel to each other, at the distance of 6 feet, 'till they reach across the river; which being covered with strong planks, and fastened with anchors and ropes, the troops march over.

Bridge *of communication*, is that made over a river, by which two armies, or forts, which are

are ſeparated by that river, have a free communication with one another.

Floating-Bridge, a bridge made uſe of in form of a work in fortification called a redout; conſiſting of two boats, covered with planks, which are ſolidly framed, ſo as to bear either horſe or artillery. Bridges of this kind are frequently uſed.

Ponton-Bridge, a number of tin or copper boats placed at the diſtance of 7 or 8 feet aſunder, each faſtened with an anchor, or a ſtrong rope that goes acroſs the river, running through the rings of the pontons. They are covered with baulks, and then with cheſts or planks, for the army to march over. See Ponton.

Caſk, or *Barrel*-Bridge, a number of empty caſks that ſupport baulks and planks, made as above into a bridge, where pontons, &c. are wanting. Experience has taught us that 5 tun of empty caſks will ſupport above water 9000 pounds: hence any calculation may be made.

Bridge, in *gunnery*, the two pieces of timber which go between the two tranſums of a gun-carriage, on wich the coins are placed, for elevating the piece. See Carriage.

BRIGADE, in *military affairs*, implies a party, or diviſion of a body of ſoldiers, whether horſe, foot, or artillery, under the command of a brigadier. There are, properly ſpeaking, three ſorts of brigades, viz. the brigade of an army, the brigade of a troop of horſe, and the brigade of artillery. A brigade of the army is either foot or dragoons, whoſe exact number is not fixed, but generally conſiſts of 3 regiments, or 6 battalions: a brigade of horſe may conſiſt of 8, 10, or 12 ſquadrons; and that of artillery, of 8 or 10 pieces of cannon, with all their appurtenances. The eldeſt brigade takes the right of the firſt line, the ſecond of the ſecond line, and the reſt in order, the youngeſt always poſſeſſing the centre. The cavalry and artillery obſerve the ſame order. The troops of horſe-guards in England are divided into ſeveral brigades, according to their ſtrength.

Brigade-*Major*, an officer appointed by the brigadier, to aſſiſt him in the management of his brigade. The moſt experienced captains are generally nominated to this poſt; who act in the brigade as major-generals do in the armies, receiving their orders from their commanders.

BRIGADIER, a military officer, whoſe rank is the next above that of a colonel; appointed to command a corps, conſiſting of ſeveral battalions or regiments, called a brigade. This title in England is ſuppreſſed in time of peace, but revived in actual ſervice in the field. Every brigadier marches at the head of his brigade upon duty. The brigadier of foot commands him of horſe in garriſon; and the brigadier of horſe, him of foot in the field. Brigadiers of the horſe-guards command as youngeſt captains of horſe, who have generally ſome higher rank in the army.

BRINGERS *up*, an antiquated military expreſſion, to ſignify the whole rear rank of a battalion drawn up, as being the hindmoſt men of every file.

BRISURE, in *fortification*, is a line of 4 or 5 fathom, which is allowed to the curtain and orillon, to make the hollow tower, or to cover the concealed flank.

BROADSIDE, in *a ſea-fight*, implies the diſcharge of all the artillery on one ſide of a ſhip of war.

BROAD-SWORD. See Sword.

BUCCANEERS, in *military hiſtory*, a name frequently applied to thoſe famous adventurers, conſiſting of pirates, &c. from all the maritime nations of Europe, who formerly joined together, and made war upon the Spaniards in America.

BUCKLER, a piece of defenſive armour uſed by the ancients, and worn on the left arm.

BUDGE-*Barrels*. See Barrel.

BUFF-*Leather*, in *military accoutrements*, is a ſort of leather prepared from the buffalo, which, dreſſed with oil, after the manner of ſhamoy, makes what is generally called buff-ſkin. Troopers coulets, ſhoulder-belts, and ſword-belts, are made of this leather. The flaps or covers to the grenadiers pouches, and to thoſe of the artillery, are made of this kind of leather.

BULLETS, are leaden balls, wherewith all kinds of ſmall fire-arms are loaded. The diameter of any bullet is found, by dividing 1.6706 by the cube root of the number, which ſhews how many of them make a pound; or it may be done in a ſhorter way. From the logarithm .2228756 of 1.6706 ſubtract continually the third part of the logarithm of the number of bullets in the pound, and the difference will be the logarithm of the diameter required.

Thus the diameter of a bullet, whereof 12 weigh a pound, is found by ſubtracting .3597270, a third part of the logarithm of 12, from the given logarithm .2228756, or, when the logarithm is leſs than the former, an unit muſt be added, ſo as to have 1.2228756, and the difference .8631486 will be the logarithm of the

diameter sought, which is .7297 inches; observing that the number found will always be a decimal, when the logarithm, which is to be subtracted, is greater than that of one pound; because the divisor is greater than the dividend in this case.

Hence, from the specific gravity of lead, the diameter of any bullet may be found from its given weight: for, since a cube foot weighs 11325 ounces, and 678 is to 355 as the cube 1728 of a foot, or 12 inches, is the content of the sphere, which therefore is 5929.7 ounces; and since spheres are as the cubes of their diameters; the weight 5929.7 is to 16 ounces, or 1 pound, as the cube 1728 is to the cube of the diameter of a sphere which weighs a pound; which cube therefore is 4.66263, and its root 1.6706 inches, the diameter sought.

Hence, the following table of leaden bullets from 1 to 39 in the pound is calculated.

⁵ₙ	0	1	2	3	4	5	6	7	8	6
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.532	.526	.521	.517	.511	.506	.501	.497	.493

The diameter of musket bullets differs but 1-50th part from that of the musket bore; for if the shot but just rolls into the barrel, it is sufficient. Government allows 11 bullets in the pound for the proof of muskets, and 14 in the pound, or 29 in two pounds, for service; 17 for the proof of carbines, and 20 for service; and 28 in the pound for the proof of pistols, and 34 for service.

BULWARK, the ancient name for bastion or rampart, which words see.

BURDEN, } in a *general sense*, implies a
BURTHEN, } load or weight, supposed to be as much as a man, horse, &c. can well carry. A sound healthful man can raise a weight equal to his own, can also draw and carry 50lb. a moderate distance. An able horse can draw 350lb. though in length of time 300 is sufficient. Hence all artillery calculations are made. One horse will draw as much as 7 men, and 7 oxen will draw as much as 11 or 12 horses.

BURIALS, as practised by the military, are as follow, viz. The funeral of a field-marshal shall be saluted with 3 rounds of 15 pieces of cannon, attended by 6 battalions, and 8 squadrons.

That of a general, with 3 rounds of 11 pieces of cannon, 4 battalions, and 6 squadrons.

That of a lieutenant-general, with 3 rounds of 9 pieces of cannon, 3 battalions, and 4 squadrons.

That of a major-general, with 3 rounds of 7 pieces of cannon, 2 battalions, and 3 squadrons.

That of a colonel, by his own battalion, or an equal number by detachment, with 3 rounds of small arms.

That of a lieutenant-colonel, by 300 men and officers, with 3 rounds of small arms.

That of a major, by 200 men and officers, with 3 rounds of small arms.

That of a captain, by his own company, or 70 rank and file, with 3 rounds of small arms.

That of a lieutenant, by 1 lieutenant, 1 serjeant, 1 drummer, 1 fifer, and 36 rank and file, with 3 rounds.

That of an ensign, by an ensign, a serjeant, and drummer, and 27 rank and file, with 3 rounds.

That of a serjeant, by a serjeant, and 19 rank and file, with 3 rounds of small arms.

That of a corporal, musician, private man, drummer, and fife, by one serjeant and 13 rank and file, with three rounds of small arms.

All officers, attending the funerals of even their nearest relations, shall notwithstanding wear their regimentals, and only have a black crape round their left arm.

The pall to be supported by officers of the same rank with that of the deceased: if the number cannot be had, officers next in seniority are to supply their place.

BURR, in *gunnery*, a round iron ring which serves to rivet the end of the bolt, so as to form a round head like that of a bolt. See CARRIAGE.

BUSKINS, a kind of shoe, or half boot, adapted to either foot; formerly a part of the Roman dress, particularly for tragic actors on the stage. They are now much worn by the army.

BUTTON, in *gunnery*, a part of the cascable, in either a gun or howitzer, and is the hind part of the piece, made round in the form of a ball. See CANNON.

BUTT, in *gunnery*, is a solid earthen parapet to fire against in the proving of guns, or in practice.

BUTTRESS. See COUNTERFORT.

CADENCE, in *tactics*, implies a very regular and uniform method of marching, by the drum and music, beating time: it may not be improperly called mathematical marching; for after the length of the step is determined, the time and distance may be found. It is by a continual practice and attention to this, that the Prussians have arrived at that point of perfection, so much admired in their evolutions.

CADET, among the military, implies a young gentleman who applies himself to the study of fortification and gunnery, &c. and who sometimes serves in the army, with or without pay, 'till a vacancy happens for his promotion. There is a company of gentlemen cadets maintained at Woolwich, at the king's expence, where they are taught all the sciences necessary to form a complete officer. Their number is 48, and commissions are given to them when qualified. The proper signification of the word is, younger brother. See ACADEMY.

CÆSTUS, in *military antiquity*, was a large gauntlet, composed of raw hides, used by wrestlers at the public games.

CAISSON, in *military affairs*, is a wooden frame or chest, made square, the side planks about 2 inches thick: it may be made to contain from 4 to 20 loaded shells, according to the execution they are to do, or as the ground is firmer or looser. The sides must be high enough, that when the cover is nailed on, the fuzes may not be damaged. *Caissons* are buried under ground at the depth of 5 or 6 feet, under some work the enemy intends to possess himself of; and when master of it, fire is put to the train conveyed through a pipe, which inflames the shells, and blows up the assailants. Sometimes a quantity of loose powder is put into the chest, on which the shells are placed, sufficient to put them in motion, and raise them above ground: at the same time that blast of powder sets fire to the fuze in the shells, which must be calculated to burn from 1 to 2½ seconds. When no powder is put under the shells, a small quantity of mealed powder must be strewed over them, having a communication with the saucisson, in order to convey the fire to the fuzes.

CAISSON, as in some old *military books*, is a covered waggon, to carry bread or ammunition.

CALCULATION, in *military affairs*, is the art of computing the amplitudes of shells, time of flight, projectile curve, velocity of shots, charges of mines, &c. together with the necessary tables for practice.

CALIBER, in *gunnery*, signifies the same as their bore or opening; and the diameter of the bore is called the diameter of its caliber. This expression regards all pieces of artillery.

CALIBER-*Compasses*, } CALLIPER-*Compasses*, } the name of a particular instrument used by gunners, for measuring the diameters of shot, shells, &c. as also the cylinder of cannon, mortars, and howitzers. They resemble other compasses, except in their legs, which are arched, in order that the points may touch the extremities of the arch. To find the true diameter of a circle, they have a quadrant fastened to one leg, and passing through the other, marked with inches and parts, to express the diameter required: the length of each ruler or plate is usually between the limits of 6 inches and a foot. On these rulers are a variety of scales, tables, proportions, &c. such as are esteemed useful to be known by gunners. The following articles are on the completest gunners-callipers, viz. 1. The measure of convex diameters in inches. 2. Of concave ditto. 3. The weight of iron shot from given diameters. 4. The weight of iron shot for given gun bores. 5. The degrees of a semicircle. 6. The proportion of troy and averdupoise weight. 7. The proportion of English and French feet and pounds. 8. Factors used in circular and spherical figures. 9. Tables of the specific gravity and weights of bodies. 10. Tables of the quantity of powder necessary for proof and service of brass and iron guns. 11. Rules for computing the number of shot or shells in a finished pile. 12. Rule concerning the fall of heavy bodies. 13. Rules for raising of water. 14. Rules for firing artillery and mortars. 15. A line of inches. 16. Logarithmetic scales of numbers, sines, versed sines and tangents. 17. A sectoral line of equal parts, or the line of lines. 18. A sectoral line of plans and superficies. 19. A sectoral line of solids.

CALQUING, } CALKING, } the art of tracing any kind of a military drawing, &c. upon some plate, paper, &c. It is performed by covering the backside of the drawing with a black or red colour, and fixing the side so covered upon a piece of paper, waxed plate, &c. This done, every line in the drawing is to be traced

traced over with a point, by which means all the outlines of the drawing will be transferred to the paper or plate, &c.

CALTROPS, in *military affairs*, is a piece of iron having 4 points, all disposed in a triangular form; so that 3 of them always rest upon the ground, and the 4th stands upwards in a perpendicular direction. Each point is 3 or 4 inches long. They are scattered over the ground and passages where the enemy is expected to march, especially the cavalry, in order to embarrass their progress.

CAMISADE, in *military transactions*, implies an attack by surprise, either during the night, or at break of day, when the enemy is supposed to be asleep.

CAMOUFLET, in *war*, a kind of stinking combustibles blown out of paper cases, into the miners faces, when they are at work in the galleries of the countermines.

CAMP, in *military affairs*, is the whole extent of ground, in general, occupied by an army pitching its tents when in the field, and upon which all its baggage and apparatus are lodged. It is marked out by the quarter-master-general, who allots every regiment its ground. The extent of the front of a regiment of infantry is 200 yards, including the two battalion guns, and depth 320, when the regiment contains 9 companies, each of 100 private men, and the companies tents in two rows; but when the companies tents stand in one row, and but 70 private men to each row, the front is then but 155 yards. A squadron of horse has 120 yards in front, and 100 for an interval between each regiment.

The nature of the ground must also be consulted, both for defence against the enemy, and supplies for the army. It should have a communication with their own garrisons, and have plenty of water, forage, and fuel, and either rivers, marshes, hills, or woods to cover it. An army always encamps fronting the enemy, and generally in two parallel lines, besides a corps de reserve, about 500 yards distant from each other: the horse and dragoons on the wings, and the foot in the centre. Where, and how the train of artillery is encamped, see *Park of artillery*, and *Encampment of a regiment of artillery*, under the word *Artillery*. Each regiment posts a subaltern's guard at 80 yards from the colours to the officers tent, called the *quarter-guard*, besides a corporal's guard in the rear: and each regiment of horse or dragoons, a small guard on foot, called the *standard-guard*, at the same distance. The grand guard of the army consists of horse, and is posted about a mile distant towards the enemy.

In a siege, the *camp* is placed all along the line of circumvallation, or rather in the rear of the approaches, out of cannon-shot: the army faces the circumvallation, if any; that is, the soldiers have the town in their rear.

One thing very essential in the establishing a *camp*, and which should be particularly attended to, if the enemy is near; is, that there should not only be a commodious spot of ground at the head of the camp, where the army, in case of surprise, may in a moment be under arms, and in a condition to repulse the enemy; but also a convenient field of battle at a small distance, and of a sufficient extent for them to form in advantageously, and move with facility. See Pl. VIII. and IX.

CAMP-*Utensils*, in war time, are hatchets, shovels, mattocks, blankets, camp-kettles, canteens, tents, poles and pins: that is, each company has 10 shovels, and 5 mattocks; each tent 1 hatchet, 2 blankets, 1 camp-kettle, with its linen bag; and each soldier 1 canteen and a knapsack.

CAMP-*Colour-men*. Each regiment has generally 6, and sometimes 1 per company: they always march with the quarter-master, to assist in making the necessary preparations against the arrival of the regiment in a new encampment. They likewise carry the camp-colours.

Flying-CAMP, or army, is generally meant a strong body of horse and foot, commanded for the most part by a lieutenant-general, which is always in motion, both to cover its own garrisons, and to keep the enemy's army in a continual alarm. It also signifies the ground on which such a body of men encamps.

CAMPAIGN, in *military affairs*, the time every year that an army continues in the field, in war time. We also say, a man as served so many campaigns, i. e. years; the campaign will begin at such a time, this will be a long campaign, &c. The word is also used for an open country before any towns, &c.

CANNON, in the *military art*, implies a tube of brass or iron; they are charged with powder and ball, or sometimes cartridges, grape, and tin-shot, &c. The length is distinguished by three parts; the first re-inforce, the second re-inforce, and the chace: the first re-inforce is 2-7ths, and the second 1-7th and a half of the diameter of the shot. The inside hollow, wherein the powder and shot are lodged, is called the bore, &c. See Plate VI. where every part is mentioned.

History

Hiſtory of Cannon. They were originally made of iron bars ſoldered together, and fortified with ſtrong iron hoops; ſome of which are ſtill to be ſeen, viz. one in the tower of London, two at Woolwich, and one in the royal arſenal at Liſbon. Others were made of thin ſheets of iron rolled up together, and hooped; and on emergencies they were made of leather, with plates of iron or copper. Theſe pieces were made in a rude and imperfect manner, like the firſt eſſays of many new inventions. Stone balls were thrown out of theſe cannon, and a ſmall quantity of powder uſed on account of their weakneſs. Theſe pieces have no ornaments, were placed on their carriages by rings, and are of cylindrical form. When or by whom they were made, is uncertain; however, we read of *cannon* being uſed as early as the 13th century, in a ſea engagement between the king of Tunis and the Mooriſh king of Seville. The Venetians uſed *cannon* at the ſiege of Claudia Jeſſa, now called Chioggia, in 1366, which were brought thither by two Germans, with ſome powder and leaden balls; as likewiſe in their wars with the Genoeſe in 1379. Our glorious king Edward III. made uſe of *cannon* at the battle of Creſſy in 1346, and at the ſiege of Calais in 1347. *Cannon* were made uſe of by the Turks at the ſiege of Conſtantinople, then in poſſeſſion of the Chriſtians, in 1394, or in that of 1452, that threw a weight of 500lb. but they generally burſt, either the firſt, ſecond, or third ſhot. Louis XII. had one caſt at Tours, of the ſame ſize, which threw a ball from the Baſtille to Charenton. One of thoſe famous *cannon* was taken at the ſiege of Dieu in 1546, by Don John de Caſtro, and is in the caſtle of St. Juiliaò da Barra, 10 miles from Liſbon; its length is 20 feet 7 inches, diameter at the centre 6 feet 3 inches, and diſcharges a ball of 100lb. It has neither dolphins, rings, nor button, is of a curious kind of metal, and has a large Indoſtan inſcription upon it, which ſays it was caſt in 1400.

Cannon { *Ball.* See Balls.
Shot. See Shot.

To CANNONADE, in *war*, is to make a very reſpectable fire out of the great guns.

CANNONIER, the perſon who manages the guns. See Gunner.

Ancient and preſent names of Cannon. Formerly they were dignified with uncommon names; for in 1503 Louis XII. had 12 braſs cannon caſt, of an uncommon ſize, called after the names of the 12 peers of France. The Spaniſh and Portugueſe called them after their ſaints. The emperor, Charles V. when he marched before Tunis, founded the 12 Apoſtles. At Milan there is a 70-pounder, called the Pimontelle; and one at Bois-le-duc, called the Devil. A 60-pounder at Dover caſtle, called Queen Elizabeth's Pocket-piſtol. An 80-pounder in the tower of London (formerly in Sterling caſtle) called Mounts-meg. An 80-pounder in the royal arſenal at Berlin, called the Thunderer. An 80-pounder at Malaga, called the Terrible. Two curious 60-pounders in the arſenal at Bremen, called the Meſſengers of bad news. And laſtly, an uncommon 70-pounder in the caſtle of St. Angelo at Rome, made of the nails that faſtened the copper plates which covered the ancient Pantheon, with this inſcription upon it: *Ex clavis trabalibus porticus Agrippæ.*

In the beginning of the 15th century theſe uncommon names were generally aboliſhed, and the following more univerſal ones took place, viz.

		Pounders.	Cwt.
Cannon royal, or carthoun	=	48	about 90
Baſtard cannon, or ¾ carthoun	=	36	79
½ carthoun	=	24	60
Whole culverins	=	18	50
Demy culverins	=	9	30
Falcon	=	6	25
Saker { loweſt ſort	=	6	13
Saker { ordinary	=	5	15
Saker { largeſt ſize	=	8	18
Baſiliſk	=	48	85.
Serpentine	=	4	8
Aſpik	=	2	7
Dragon	=	6	12
Syren	=	60	81
Falconet	=	3, 2, & 1	15, 10, 5.

Moyens, which carried a ball of 10 or 12 ounces, &c.

Rabinet, which carried a ball of 16 ounces.

Theſe curious names of beaſts and birds of prey were adopted, on account of their ſwiftneſs in motion, or of their cruelty; as the *falconet, falcon, ſacker, and culvering*, &c. for their ſwiftneſs in flying; the *baſiliſk, ſerpentine, aſpike, dragon, ſyren*, &c. for their cruelty. See the Latin poet Forcaſtarius.

At preſent *cannon* take their names from the weight of the ball they diſcharge: thus a piece that diſcharges a ball of 24 pounds, is called a 24-pounder; one that carries a ball of 12 pounds, is called a 12-pounder; and ſo of the reſt, divided into the following ſorts, viz.

Ship-

Ship-guns, consisting in 42, 36, 32, 24, 18, 12, 9, 6, and 3 pounders.

Garrison-guns, in 42, 32, 24, 18, 12, 9 and 6 pounders.

Battering-guns, in 24, 18, and 12 pounders.

Field-pieces, in 12, 9, 6, 3, 2, $1\frac{1}{2}$, 1, and $\frac{1}{2}$ pounders, whose dimensions are explained in the following tables, except the small pieces, which differ in length and weight, viz.

TABLE *of Ship-guns, settled in* 1753.

Brass Ship-guns.						Iron Ship-guns.					
Caliber.	Length.		Weight.			Caliber.	Length.		Weight.		
42	9	6	61	2	10	42	10	0	55	1	12
32	9	5	55	2	7	32	9	6	53	3	23
24	9	5	51	1	12	24	9	5	48	0	0
18	9	0	48	1	0	18	9	0	41	1	8
12	9	0	29	0	0	12	9	0	32	3	3
9	8	5	26	0	0	9	8	5	23	2	2
6	8	0	19	0	0	6	7	0	17	1	14
3	6	5	11	0	0	4	6	0	12	2	13
						3	4	6	7	1	7

N. B. The length is expressed in feet and inches, and the weight in centres, quarters, and pounds.

TABLE *of Garrison-pieces.*

Brass Garrison-pieces						Iron Garrison-pieces					
Caliber.	Length.		Weight.			Caliber.	Length.		Weight.		
42	10	0	64	0	0	32	9	8	56	0	0
32	9	2	49	2	18	24	9	8	48	0	0
24	8	4	37	0	0	18	9	0	36	0	0
18	7	6	27	3	0	12	7	8	24	0	0
12	6	7	18	2	0	9	7	0	18	0	0
9	6	0	13	3	0	6	6	1	12	0	0
6	5	3	9	1	0	4	5	4	8	0	0

Brass Battering-pieces.

New pieces.					
Caliber.	Length.		Weight.		
24	9	8	27	0	0
18	9	0	20	1	0
12	7	8	13	2	0

Brass Field-pieces.

New pieces.					
Caliber.	Length.		Weight.		
12	5	0	8	3	8
6	4	6	4	3	10
3	3	6	2	3	10

The metal of which brass cannon are made, is in a manner kept a secret by the founders; yet, with all their art and secresy, they have not hitherto found out a composition that will stand a hot engagement without melting, or at least being rendered useless. Those cast at Woolwich bid fairest towards this amendment. The respective quantities which should enter into this composition, is a point not decided; every founder has his own proportions, which are peculiar to himself. The most common proportions of the ingredients are the following, viz. To 240 lb. of metal fit for casting, they put 68 lb. of copper, 52 lb. of brass, and 12 lb. of tin. To 4200 lb. of metal fit for casting, the Germans put $3687\frac{33}{41}$lb. of copper, $204\frac{13}{41}$lb. of brass, and $307\frac{36}{41}$lb. of tin. Others again use 100 lb. of copper, 6 lb. of brass, and 9 lb. of tin; and lastly, others 100 lb. of copper, 10 lb. of brass, and 15 lb. of tin. With respect to iron guns, their structure is the same as that of the others, and they generally stand the most severe engagements, being frequently used on ship-board. Several experiments have taught us that the Swedish iron guns are preferable to all others.

CANNON is now generally cast solid, and the cavity bored afterwards by a very curious machine for that purpose, where the gun is placed in a perpendicular position; but of late these machines have been made to bore horizontally, and much truer than those that bore in a vertical form. This new machine was first invented at Strasburg, and greatly improved by Mr. Verbruggen, a Dutchman, at present head founder at the royal foundery at Woolwich, where probably the best horizontal-boring machine in Europe has been lately fixed; it both bores the inside, and turns and polishes the outside at once.

Names of the several parts of a CANNON. See Plate VI.

The grand divisions exterior, are as follow, viz. *First re-inforce,* is that part of a gun next the breech, which is made stronger, to resist the force of powder.

Second re-inforce. This begins where the firſt ends, and is made ſomething ſmaller than the firſt.

The chace, is all that part from the trunnions to the muzzle.

The muzzle, properly ſo called, is the part from the muzzle aſtragal to the end of the piece.

Small diviſions exterior.

The caſcable, the hindermoſt part of the breech, from the baſe-ring to the end of the button.

The caſcable-aſtragal, is that diminiſhing part between the two breech-mouldings.

The neck of the caſcable, is that narrow ſpace between the breech-moulding and the button.

The breech, is that ſolid piece of metal behind, between the vent and the extremity of the baſe-ring, and which terminates the hind part of the gun, excluſive of the caſcable.

The breech-mouldings, are thoſe eminent parts, as ſquares or rounds, which ſerve only for ornaments to the piece, &c.

The baſe-ring and ogee, are ornamental mouldings: the latter is always in the ſhape of an S, taken from civil architecture, and uſed in guns, mortars, and howitzers.

The vent-field, is the part from the vent to the firſt re-inforce aſtragal.

The vent aſtragal and fillets, are the mouldings and fillets at or near the vent.

The charging cylinder, is all the ſpace from the chace-aſtragal to the muzzle-aſtragal.

The firſt re-inforce ring and ogee, is the ornament on the ſecond re-inforce.

The firſt re-inforce aſtragal, is the ornament between the firſt and ſecond re-inforce.

The chaſe-girdle, is the ornament cloſe to the trunnions.

The trunnions, are two ſolid cylindrical pieces of metal in every gun, which project the piece, and by which it is ſupported upon its carriage.

The dolphins, are the two handles placed on the ſecond re-inforce ring of braſs guns, reſembling the fiſh of that name: they ſerve for mounting and diſmounting the guns.

The ſecond re-inforce ring and ogee, are the two ornaments joining the trunnions.

The ſecond reinforce-aſtragal, is the moulding neareſt the trunnions.

The chaſe-aſtragal and fillets, the two laſt-mentioned ornaments jointly.

The muzzle-aſtragal and fillets, the joint ornaments neareſt the muzzle.

The muzzle-mouldings, the ornaments at the very muzzle of the piece.

The ſwelling of the muzzle, the projected part behind the muzzle-mouldings.

Interior parts.

The mouth, or entrance of the bore, is that part where both powder and ball are put in, or the hollow part which receives the charge.

The vent, in all kinds of fire-arms, is vulgarly called the touch-hole: it is a ſmall hole pierced at the end, or near it, of the bore or chamber, to prime the piece with powder, or to introduce the tube, in order, when lighted, to ſet fire to the charge.

The chamber, which is only in large calibres, is the place where the powder is lodged, which forms the charge.

Tools for loading and firing CANNON, are rammers, ſponges, ladles, worms, hand-ſpikes, wedges, and ſcrews.

Coins, or *wedges,* to lay under the breech of the gun, in order to elevate or depreſs it.

Hand-ſpikes, ſerve to move and to lay the gun.

Ladles, ſerve to load the gun with looſe powder.

Rammers, are cylinders of wood, whoſe diameters and *axes* are equal to thoſe of the ſhot: they ſerve to ram home the wads put upon the powder and ſhot.

Sponge, is fixed at the oppoſite end of the rammer, covered with lamb-ſkin, and ſerves to clean the gun when fired.

Screws, are uſed to field-pieces, inſtead of coins, by which the gun is kept to the ſame elevation.

Tools neceſſary for proving CANNON, are, a ſearcher with a reliever, and a ſearcher with one point.

Searcher, is an iron, hollow at one end to receive a wooden handle, and on the other end has from 4 to 8 flat ſprings of about 8 or 10 inches long, pointed and turned outwards at the ends.

The Reliever, is an iron flat ring, with a wooden handle, at right angles to it. When a gun is to be ſearched after it has been fired, this ſearcher is introduced and turned every way, from end to end; and if there is any hole, the point of one or other of the ſprings gets into it, and remains 'till the reliever, paſſing round the handle of the ſearcher, preſſing the ſprings together, relieves it.

When there is any hole or roughneſs in the gun, the diſtance from the mouth is marked on the outſide with chalk.

The other ſearcher has alſo a wooden handle, and a point at the fore end, of about an inch long, at right angles to the length: about this point is put ſome wax, mixed with tallow, which, when introduced into the hole or cavity, is preſſed

pressed in, when the impression upon the wax gives the depth, and the length is known by the motion of the searcher backwards and forwards: if a hole is $\frac{1}{9}$ of an inch deep, the gun is rejected. See INSTRUMENTS.

Charges for all the different pieces, and on all occasions, in garrison and the field.

In order to render this difficult article visible on speculation, I have formed the following table. See PROOF.

Nat.	Proof				Service.				Saluting.		Ricochet.		Diameter of				Length of cast.			
	Brass.		Iron.		Brass.		Iron.						Guns.		Shot.		Proof.		Service	
pds.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	In.	pts.	In.	pts.	In.	pts.	In.	pts.
42	31	8	25		14		12		10	4	4	7	7	018	6	684	26	94	17	79
32	26	12	21	8	10	10	9	4	8		2	12	6	410	6	105	26	3	16	25
24	21		18		8		8		6		2		5	824	5	547	25	58	14	78
18	18		15		6		8		4	8	1	12	5	292	5	040	24	92	13	46
12	12		12		4		4		3		1	6	4	623	4	403	23	24	11	72
9	9		9		3		3		2	8	1	4	4	200	4		21	26	10	63
6	6		6		2	8	2	8	2		1		3	668	3	498	18	7	9	35
4	4		4		1	6	1	8	1	4		12	3	204	3	003	16	43	8	12
3	3		3		1		1			12		8	2	913	2	775	14	84	7	44
$1\frac{1}{2}$	1	8	1	8		8		8		6		4	2	031	2	020	11	76	5	88
1	1		1			5		5		4		$2\frac{1}{4}$	2	010	1	923	8	35	3	18

The price of artillery.

The government pays 130l. per ton for brass cannon, 12l. for each horse; and a fixed price is allowed for carriages, wheels, iron-work, tumbrels, ammunition, and ball. For cannon ball the government allows 16l. per ton, and 8l. 8s. per quintal for gunpowder. Hence a 24-pounder, with all its appurtenances, ready to act against an enemy, stands the government in 324l. 19s. $5\frac{1}{4}$d. a 12-pounder, in 208l. 10s. 6d. and a 6-pounder, in 119l. 14s. $6\frac{3}{4}$d.

CANNON-*Baskets*. See GABIONS.

To nail CANNON. See NAIL.

CANTEENS, in *military articles*, implies a tin vessel used by the soldiers on a march, &c. to carry water or other drinkables in, and holds about 2 quarts.

CANTONMENTS, in *military affairs*, is the quartering the army as near to each other as possible, and in the same manner they incamped in the field. The chief reasons for cantoning an army are, first, when the campaign begins early; on which occasion, in cantoning your troops, two objects demand attention, viz. the military object, and that of subsistance: the 2d is, when an army has finished a siege early, the troops are allowed to repose 'till the fields produce forage for their subsistance: the 3d reason is, when the autumn proves rainy, and forage scarce, the troops are cantoned to protect them from the bad weather.

CANVAS-*Bags*. See BAGS, *Sand*-BAGS, &c.

CAPS, in *gunnery*, are pieces of leather, or more commonly sheep-skins, to cover the mouth of mortars when loaded, 'till they are fired, to prevent damps, or rain getting in.

CAP-*Squares*. See CARRIAGES.

CAPITAL, in *fortification*, is an imaginary line which divides any work into two equal and similar parts. It signifies also, a line drawn from the angle of a polygon to the point of the bastion, or from the point of the bastion to the middle of the gorge.

CAPITULATION, in *military affairs*, implies the conditions on which the garrison of a place besieged agree to deliver it up, &c. This is likewise the last action, both in the attack and defence of a fortification, the conditions of which may be of various kinds, according to the different circumstances or situations in which they are.

As soon as the capitulation is agreed on, and signed, hostages are generally delivered on both sides, for the exact performance of the articles; part of the place is delivered to the besiegers, and a day appointed for the garrison to evacuate the place. The usual and most honourable conditions are, with arms and baggage, drums beating, and colours flying, matches lighted, and some pieces of artillery; waggons, and convoys for the baggage, sick and wounded, &c.

CAPONIER, in *fortification*, is a passage made from one work to another, of 10 or 12 feet wide, and about 5 feet deep, covered on each

each side by a parapet, terminating in a glacis. Sometimes they are covered with planks and earth. See FORTIFICATION.

CAPSTERN, } in *military mechanics*, signifies
CAPSTAN, } a strong massy piece of timber in the form of a truncated cone, and having its upper part, called the drum-head, pierced with a number of square holes, for receiving the levers; and by turning it round, several actions may be performed that require an extraordinary power.

CAPTAIN, in *military affairs*, is a military officer, who is the commander in chief of a company of foot, artillery, horse, or dragoons. The name of captain was the first term made use of to express the chief or head of a company, troop, or body of men. He is both to march and fight at the head of his company. A captain of artillery and engineers ought to be more a master of the attack and defence of fortified places than either a captain of infantry or cavalry; because they must be good mathematicians, and understand the raising of all kinds of batteries, to open the trenches, to conduct the sap, to make mines and fougasses, and to calculate their charges. They ought further to be well acquainted with the power of artillery, the doctrine of the military projectile, and the laws of motion, together with the system of mechanics; and should be good draughtsmen. A captain has in most services the power of appointing his own serjeants and corporals, but cannot by his own authority break them; neither can he punish a soldier with death, unless he revolts against him on duty. Among the horse, when captains of several regiments meet, he that has the eldest commission takes place and commands; but among the foot, the captain of the eldest regiment commands all that are of younger regiments, though they have elder commissions. The same denomination is given to him that commands a ship of war, or the like. Captains of the guards in the English service rank as colonels in marching regiments; the captains of artillery in the Prussian service rank as majors in the army, and have an extraordinary pay, on account of the great qualifications that monarch demands of them; and the captains of bombardiers, miners, and artificers, in the Portuguese service, have 3l. 7s. 6d. a month more than the captains of artillery in the same regiment.

CAPTAIN-*Lieutenant*, the commanding officer of the colonel's company or troop in every regiment. He commands as youngest captain, though in reality he is only the first lieutenant, the colonel being himself captain. This denomination was abolished in the English army in 1772, when it was ordered that for the future all captain-lieutenants should have the rank and title of captains in the army. This title is still used in all foreign services.

CAPITAINE *en pied*, or captain in pay, one who is not reformed, but keeps in full pay, and exempt from duty. This expression occurs sometimes in history.

CAPTAIN *reformed*, one who, upon reducing the forces on the termination of war, loses his company, yet keeps his rank and pay, whether on duty or not.

CAPTAIN *on half pay*, is one who loses his company on the reduction of an army, and retires on half-pay, until seniority puts him into duty and full pay again.

CAPTAIN *en second*, or second captain, is one whose company has been broke, and who is joined to another, to serve under the captain of it. This is customary in France, but not in England.

CAPITAINE *des gardes*, or captain of the guards, is the captain of a company in any of the regiments of guards.

CAP-A-PEE, in *military antiquity*, implies being clothed in armour from head to foot.

CARABINE, in *military affairs*, is a fire-arm somewhat smaller than the firelocks of the infantry, and used by all the horse. It carries a ball of 24 in the pound: its barrel is 3 feet long, and the whole length, including the stock, 4 feet.

Rifled-CARABINES, are generally of the same dimensions with the above, the barrel of which is rifled spirally from the breech to the mouth, so that when the ball, which is forced into it, is driven out again by the strength of the powder, it is lengthened about the breadth of a finger, and marked with the rifle of the bore. Fire-arms of this kind have a much greater range than any other, because the rifle of the barrel impedes the ball, which by that means makes the greater resistance at the first inflammation of the powder, giving time for the whole charge to take fire, before the ball is out of the bore. These arms are used by the hunters, or light infantry.

CARABINEERS, or *Carbineers*. All regiments of light-armed horse were formerly called so; but since the forming of hussars and chasseurs, they have lost that denomination; and now all the foreign heavy cavalry are called carabineers.

CARCASS, in *military affairs*, are of two sorts, oblong and round: the uncertain flight of the first sort has almost rendered them useless.

lefs. They are prepared in the following manner: boil 12 or 15lb. of pitch in a glazed earthen pot; mix with that 3 lb. of tallow, 30lb. of powder, 6lb. of falt-petre, and as many ftopins as can be put in. Before the compofition is cold, the carcafs muft be filled; to do which, fmear your hands with oil or tallow, and fill the carcafs $\frac{1}{4}$ full with the above compofition; then put in loaded pieces of gun or piftol barrels, loaded grenades, and the intervals with compofition; and cover the whole over with coarfe cloth, well fewed together, keeping it in a round form. Then put it into the carcafs, having a hollow top and bottom, with bars running between them to hold them together, and compofed of 4 flips of iron joined at top, and fixed at the bottom, at equal diftances, to a piece of iron, which, together with the hoops, when filled, form a complete globular body. When quite finifhed and cold, it muft be fteeped in melted pitch, and then inftantly immerged in cold water. Laftly, bore 3 or 4 holes at top, and fill the fame with fuze compofition, covering the holes with pitch until ufed. They are thrown out of mortars, and weigh from 50 to 230lb. according to the fize of the mortars they are thrown out of. There are other carcaffes for the fea-fervice, which differ from a fhell only in the compofition, and the 4 holes from which it burns when fired.

Carcasses were firft ufed by the bifhop of Munfter, at the fiege of Groll in 1672, where the duke of Luxembourg commanded.

CARRIAGES, in *military affairs*, are of various kinds, viz.

Garrifon-Carriages, are thofe on which all forts of garrifon pieces are mounted. They are made much fhorter than field-carriages, and have generally iron trucks inftead of wheels. Their dimenfions are all fpecified in the following table, together with the names of every article thereto belonging. The dimenfions are expreffed in inches and decimals, except the head column, which is the nature of the gun, from a 42 to a 3-pounder. The arms of the hind axle-tree, having the fame dimenfions as thofe of the fore ones, are omitted, as alfo the height behind the fide pieces. See Pl. VI. fig. 2.

Nature of the gun		42	32	24	18	12	9	6	3
Width inclofed	before	18	18	16.5	15.5	14	13	11.5	9
	behind	23.5	23.5	22.5	21.5	19.5	18.5	16.5	12.5
Fore axle-tree length		57	57	54.5	54.5	45.5	42.5	38.8	32.5
Body	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	10.8	10.8	10.	10	10	9.5	9.	8.3
	breadth	6.8	6.8	6.8	6	5.5	5.2	5.	4
Arms	length	10.8	10.2	9.8	9.2	8	7.5	7	5.3
	diameter	6.2	6.2	6.2	5.8	5.2	5	4.5	3.5
Hind axle-tree length		57	57	54	51.5	45.5	42.5	38.8	32.5
Body	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	6.8	6.8	6.8	6	5.5	5.2	5	4.
	breadth	12	12	12	12	12	12	12	12.
Fore-trucks	diameter	19	19	18	18	16	16	14	14
	breadth	6.5	6.5	5.5	5	4.5	4	3.5	3
Hind-trucks	diameter	16	16	16	15	14	14	12	10.
	breadth	6.5	6	5.5	5	4.5	4	3.5	3
Side-pieces	height before	26.8	26.2	26.	23.6	20	18.8	16	13.6
	length	78	78	72	69	66	63	60	37.5
	breadth	6.5	6.	5.5	5	4.5	4	3.5	3.
Trunions from the head		8	8	8	8	6.8	6.6	6.6	6

Names of all the iron-work of a garrifon-Carriage, *together with the quantity of each fort.*

Cap-fquares	2
Eye-bolts	2
Joint-bolts	2
Tranfom-bolt	1
Bed-bolt	1
Bracket-bolts	2
Hind axle-tree bolts	4
Burs	2
Loops	6
Dowel-pins	4
Square riveting-plates	8
Rings and keys	10
Traverfing-plates	2
Linch-pins	4

Axle-

Axle-tree hoops	2
Axle-tree ſtays	2
Keys, chains, and ſtaples	2
Stool-bed bolts, &c.	2

N. B. As the trucks of garriſon-carriages are generally made of caſt-iron, their axle-trees ſhould have copper clouts underneath, to diminiſh the friction of the iron againſt the wood. Travelling-carriages are in many reſpects very unfit for garriſon ſervice, though frequently uſed.

Travelling-CARRIAGES, are ſuch as guns are mounted on for ſieges, and for the field: they are much longer, and differently conſtructed from garriſon-carriages; having 4 wheels, 2 for the carriage, and 2 for the limber, which laſt are only uſed on marches. The names and dimenſions of each part are ſpecified in the following tables.

Cheeks.

Nature of the guns	24	18	12	6	3
Length of the cheeks in feet	13.	12.5	12	11	10
Thickneſs of the cheeks in inches and decimals	5.8	5.2	4.6	3.6	3.
Height of the plank	22	21.6	19	16	13
Height of the cheek — before	20	19.6	17	14	11.5
Height of the cheek — centre	17	16.6	15	10	9.5
Height of the cheek — trail	12	11.6	11	10	7.5
Head from the centre	74	72	69	60	5.5
Length of the trail	18	16.6	15	12	10

Of the axle-trees.

Nature of the guns	24	18	12	6	3
Body — length	38.5	38.8	39.	40	40.5
Body — breadth	7	7.8	6.5	6	5.5
Body — height	9	9.8	8.5	8	7.5
Arms — length	21	20.8	20.5	19	17.5
Arms — body diameter	7	6.8	6.5	6	5.5
Arms — linch diameter	5	4.8	4.5	4	3.5
Total length	81	80.5	80	78	76

Of the wheels.

Calibers, or nature of the guns	24	12	6	3	parts
Wheels diameter	58	58	58	58	
Nave length	17.5	17	15.5	12.5	76
Diameter — body	15	15	13	12.5	62
Diameter — middle	10	16	14	13	74
Diameter — linch	13.5	13.5	10	10	60
Fellies — thickneſs	5	4.5	4	3	22
Fellies — breadth	6.5	6	5.5	5	28
Spokes — thickneſs	2.3	2.2	2.	2	10
Spokes — breadth	4.5	4	3.5	3	0

N. B. The explanation of this table is as the former, except the laſt column, which expreſſes general dimenſions, taken from the diameter of the ſhot, divided into 24 equal parts; a method by which all the dimenſions of both guns and carriages ſhould be regulated.

Names and quantity of the iron-work of a Travelling-Carriage.

Tranſom-bolts, with burs — breaſt	1
Tranſom-bolts, with burs — centre	2
Tranſom-bolts, with burs — trail	2
Tranſom-plates, with hooks — breaſt	2
Tranſom-plates, with hooks — centre	2
Tranſom-plates, with hooks — trail	2
Trunnion-plates	2
Cap-ſquares with joint-bolts	2
Spring-keys, with chain and ſtaples	4
Eye-bolts — fore	2
Eye-bolts — hind	2
Single forelock keys	8
Bed piece, chain and ſtaple	1
Locker — hinges	2
Locker — haſp with ſtaples	1

Wood

Wood fcrews		
Plates, with rofes	garnifh	2
	trail	2
Breaft-plates		2
Garnifh	bolts	2
	nails	6
Axle-tree-bands		2
Side-ftraps		4
Draught-rings, with bolts and burs		2
Locking-plates		2
Lafhing rings and loops		8
Nails	rofe-buds	4
	diamond-headed	8
	counterfunk	
	trail	26
Pintle-plates		2

Names and quantity of all the parts of a wheel and iron-work.

Nave	1
Spokes	12
Fellies	6
Dowel-pins	6
Streaks	6
Streak-nails	6
Nave-boxes	2
Dowledges	6
Nave-hoop-ftubs	9
Box pins	6
Rivets for the dowledges	24
Nave hoops	3

Names and quantity of iron-work of an axle-tree.

Axle-tree-bar		1
Clouts	body	2
	linch	2
Axle-tree-hoops	linch	2
	arms	2
	body	2
Hurters with ftraps		2
Wafhers		2
Linch-pins		2
Axle-tree-bolt		1
Single forelocks		2
Clout-nails		12
Dog-nails		8
Axle-tree--hoops		2

N. B. The dimenfions of carriage limbers will be mentioned in the article *Field*-CARRIAGES, as they are the fame with travelling carriages.

Field CARRIAGES, are both fhorter and lighter than thofe before mentioned, bearing a proportion to the pieces mounted thereon: the names and dimenfions of every part are fpecified in the following tables. See Pl. VII. fig. 1 and 2.

Calibres		24	12	6	parts
Cheeks	length	108.	106.	94.	13.4
	height	15.6	14.	12.4	3.6
	thicknefs	4.5	3.7	3.	0.18
Checks	height before	14.5	12.7	11.	2.18
	at the centre	12.	10.9	9.8	2.16
	at the trail	10.	9.2	8.	1.16
Length of the trail		11.	10.5	10.	1.22
From head to centre		50.	45	40.	11.6
Width	before	11.5	10.7	10.	2.1
	behind	17.	15.	13.	2.15
Lockers	length	——	——	23.	
	breadth	——	——	13.3	
	depth	——	——	4.3	
Length of the trail hand-fpike		63.	60.	57.	
Diameter at the trail of ditto		4.	3.5	3.	
Screw for elevation	handles in length	——	5.	4.	
	height	——	10.5	9.	
	diameter	——	2.	1.5	
	diameter of focket	——	3.	2.5	
Wheels height		50.	50.	50.	45.
Nave length		15.	13.	12.7	3.
Wheels diameter	body	13.	11.	10.6	2.10
	middle	14.	12.	11.6	2.15
	linch	12.	11.	10.	2.5
Fellies	height	4.7	4.	3.6	1.
	breadth	3.3	2.8	2.4	0.16
Spokes	breadth	2.	1.8	1.7	0.9
	thicknefs	3.5	3.2	2.9	0.17

Limbers, are two-wheel carriages, fometimes made with fhafts, and fometimes with beams for drawing double: they ferve to fupport the trail of *field-carriages*, by means of the pintle or iron bolt, when artillery is tranfported from one place to another; and are taken off again when the pieces are to be fired, unlefs upon a march, when harraffed by the enemy, &c. Their conftruction is in the following tables. See Pl. VII. fig. 3 and 4.

Calibres

Calibres		24	12	6	3	parts
Nave	length	48.	48.	48.	[illegible]	
	diameter of the body	16.	15.	14.	10.	
	——— middle	14.	14.	13.	12.5	2.15
	——— linch	12.	12.	11.	10.	2.10
Fellies	breadth	4.5	4.	3.5	3.	0.20
	height	5.	4.5	4.	3.5	
Spokes	breadth	1.8	1.6	1.4	1.2	0.9
	thickneſs	4.	3.5	3.	2.5	0.19
Body	length	40.	40.	40.	43.	
	height	7.6	7.	6.	5.5	
	breadth	6.	5.5	5.	5.	
Arms length		19.	18.	17.	13.	
Diameters	body	5.	4.	4.	4.	0.23
	linch	4.	3.	3.	3.	0.19
Shafts length		94.	94.	94.	94.	
Breadth	hind end	6.	5.5	5.	4.	1.5
	fore end	3.	3.	2.5	2.5	0.15
Height	hind end	3.3	3.	3.	3.	0.16
	fore end	3.	3.	2.5	2.5	0.15
Beams	length	110.	110.	110.	110.	
	breadth, hind end	4.5	4.	3.5	3.	
	———, fore end	4.	3.5	3.	2.5	
Bolſter	height	12.5	10.	8.	7.	
	length	36.	36.	36.	36.	
	breadth	6.	5.5	5.	5.	1.4
Fore croſs-bar	breadth	4.5	4.	3.5	3.	0.20
	height	1.5	1.5	1.5	1.5	
Hind croſs-bar	breadth	3.5	3.5	3.5	3.5	0.16
	height	1.5	1.5	1.5	1.5	
Axle-tree from the fore croſs-bar		11.5	11.5	11.5	11.5	2.1

Names of all the iron-work of the ſhafts and beams of limbers, with the quantity of each ſort.

- Limber-bolt — — 1
- Shaft-rings — — 2
- Shaft-pins with chains — 2
- Ridge-chain hook and loop — 1
- Limber-chain hook and rings — 1
- Breech-hooks — — 2
- Single forelock-keys — — 4
- Nails, diamond-headed — — 8
- Dog-nails — — — 6
- Bolſter-hoops — — — 2
- Pintle — — — 1
- Pintle-waſhers and plates — — 2

N. B. The iron-work of the wheel and axle-tree are the ſame as mentioned before, under the articles *wheels*, *axle-trees*, and under the general term CARRIAGES.

Galloper-CARRIAGES, ſerve for 1½-pounders. Theſe carriages are made with ſhafts, ſo as to be drawn without a limber. In the laſt war the king of Pruſſia mounted light 3-pounders on theſe carriages, which anſwered very well. Their dimenſions are

		feet	inch.	parts
Total length of the ſhafts		11		27
From the	fore end to the fore croſs-bar	6	4.	16
	hind end to the round part	5		11
Height at the	hind end		6.	3.10
	fore end		3.	3
Breadth	behind and before		3.5	8.15
	in the middle		4.5	9.
Width within behind		2	6.5	7
At the fore	croſs-bar	2	4.	7.10
	end	2	1.	7.
From the hind end to the axle-tree			11.	3
Croſs-bar from the hind end			3.	12
Length of the checks		4	2.	11
Breadth of the fore checks			2.5	1
Width within	before		8.	2
	behind		11.5	1.20
Height of the checks			6.5	1.15
Total length of the axle-tree		6	4.	18
Length of the	body	3	6.5	
	arms	1	4.6	
Breadth of the body			5.	
Height of ditto			6.	
Greateſt diameter of the arms			5.	
Leaſt diameter of ditto			3.3	
Diameter of the wheels		4	3.	13.5
Nave length		1	1.	4.5
Diameters	body		11.	3
	middle	1		3.5
	linch		10.	2.20
Spokes	breadth		1.5	.20
	thickneſs		3.	1.
Fellies	breadth		3.	1.
	height		4.5	1.10

N. B. The

N. B. The dimensions, not inserted here, may be taken from the draughts, where they are all mentioned, as likewise the iron-work.

Howitz-CARRIAGES, are for transporting howitzers; and those for the 6 and 5.8-inch howitzers are made with screws to elevate them, in the same manner as the light 6-pounders; for which reason they are made without a bed, and the centre transom must be 9 inches broad to fix the screw, instead of 4 for those made without: in the centre, between the trail and centre-transom, there is a transom-bolt, which is not in others, because the centre-transom must be made to be taken out; after which the howitzer can be elevated to any angle under 90 degrees. Their dimensions are as follow:

Length of the cheeks		8	5.	6.
Thickness of the cheeks			4.5	8.
Height of the cheeks before		1	6.	1.8
——— at the centre		1	4.	1.
——— at the trail		1	2.	.17
Length of the trail		1	3.	1.
Height of the plank		1	6.	
From the head to the centre		3	7.	
Trunnion-holes from the head			9.	.15
Breast-transom	length	1	2.5	.21
	height		2.	
	thickness		4.5	.9
Centre-transom	length	1	4.	1.3
	height		2.5	
	thickness		4.5	.10
Trail-transom	length	1	7.	1.5
	height	1	3.	
	thickness		4.5	.23

The iron-work of these carriages is the same as in the field-carriages (which see) except that here are only 4 garnish-nails, 2 on each side: the cheeks, being so short, will admit of no more. The wheels and axle-trees are the same as in the 18 and 12-pounder carriages.

Tumbrel-CARRIAGE. See TUMBREL.

Block-CARRIAGE, is purposely for conveying mortars and their beds from one place to another; the dimensions of which are as follow:

		inch.
Fore-wheel height		48
Nave length		15
Diameters	body	14
	middle	15
	linch	13
Fellies	height	5.5
	breadth	3.5
Spokes	breadth	2
	thickness	3
		Inch.
Hind-wheels height		60
Nave length		17
Diameters	body	14
	middle	15
	linch	13
Fellies	height	6.5
	breadth	4
Spokes	breadth	2.3
	thickness	4
Fore axle-tree total length		77
Body	length	39
	breadth	6.5
	thickness	8
Arms length		19
Diameters	body	6
	linch	4
Bolster	length	49
	breadth	6.5
	height	7
Hind axle-tree total length		77
Body	length	37
	breadth	7
	height	8.7
Arms length		20
Diameters	body	6.4
	linch	4.8
Bolster	length	47
	breadth	7
	height	8
Side-pieces	length	132
	breadth	6.5
	height	6.5
Distance between the axle-trees		
Side-pieces project equally by		
Shafts length		96
Length of the strait-bar		19
Shafts breadth	behind	5.3
	middle	6
	before	3
Opening of the strait bar	behind	28.5
	middle	32.5
	before	24
Height of the shafts		5
Rider	length	46
	breadth	6.5
	height	8
Interval between the side-pieces		12
Side-pieces are let into the rider and hind-bolster.		2

Truck-CARRIAGES, are to carry timber and other heavy burthens from one place to another, at no great distance: they serve also to convey guns or mortars upon a battery, where their own carriages cannot go, and are drawn by men as well as horses. Their dimensions are as follow:

Fore-

		Inch.
Fore axle-tree	body length	32
	breadth	5
	height	11
	arms length	6.5
	diameter	3
Hind axle-tree	body length	32
	breadth	6
	height	7.5
	arms length	6.5
	diameter	3
Side-pieces	length	100
	breadth	10
	height	2.5
	interval	10
	to the fore axle-tree	15
	to the hind axle-tree	15
Fore-bolster	length	32
	breadth	5
	height	6
Hind-bolster	length	32
	breadth	6
	height	8
Shafts	length	96
	height	3.3
Opening	near the bolt	23
	middle	35
	before	24
Breadth	before	3
	middle	4
	at the bolt	3.5
From the end to the strait cross-bar		12
Fore-guide	length	30
	breadth	21
	height	4
	interval	10
Trucks	diameter	23
	thickness	4

The cross piece fixed upon the fore ends of the side pieces, is 5 inches broad, 3 high before, and 1.5 behind. The cross piece behind the fore bolster and the side pieces, is 10 inches broad, and 1.5 thick. The bolsters are let into the side pieces about 3-4ths of an inch. The iron-work is so distinctly seen in the plan and elevation of the carriage, that it would be needless to mention it.

Ponton-Carriage. Carriages of this kind are solely for transporting the pontons: they had formerly but two wheels, but are generally now made with four. The making use of two-wheel carriages for travelling a great way, is contrary to sense and reason; because the whole weight lying upon the two wheels, must make them sink deeper into the ground, than those of a four-wheel carriage: Their dimensions are as follow:

		Inch.
Wheels diameter, both behind and before		63
Nave length		15
Diameters	body	14
	middle	15
	linch	12
Fellies	breadth	4
	height	4.5
Spokes	breadth	2
	thickness	3.5
Axle-tree length		88
Body	length	46
	breadth	6
	height	8.5
Arms length		18
Diameter	body	6
	length	3.8
Side-pieces	under	210
	upper	206
Under side-pieces	breadth	7
	height	6
Upper side-pieces	breadth	5
	height	2.6
Fore and hind cross-bars	breadth	6.5
	height	3.5
	length	52
Centre of the fore axle-tree distant from the fore end		10
Centre of the hind axle-tree distant from the hind end		93
Opening between the	upper side-pieces	51
	under side-pieces	18
Fore supporter, distant from the fore end		45
Hind supporter, distant from the hind end		[illegible]
Height of the supporters		[illegible]

CAROUSAL, in *military history*, signifies a magnificent entertainment, exhibited by princes or other great personages, on some public occasion; consisting of cavalcades of gentlemen richly dressed and equipped, after the manner of the ancient cavaliers divided into squadrons, meeting in some public place, and performing jests, tournaments, &c.

To Carry *on the trenches*. See Trenches.

CART, in a *military sense*, is a vehicle mounted on two wheels, and drawn by one or more horses; of which there are several sorts, viz.

Powder-Carts, are for carrying powder with the army: they are divided into 4 parts, by boards of an inch thick, which enter about an inch into the shafts. Each of these carts can only stow 4 barrels of powder. The roof is covered with an oil-cloth, to prevent dampness from

from coming to the powder, and their dimensions are as follow :

		inch.
Wheels diameter		65
Sides and shafts total length		180
From the hind	end to the cross-bar	5.5
	cross-bar, to the fore cross-bar	88.5
From the fore cross-bar to the fore end		77.5
Breadth	behind	3.3
	fore cross-bar	4.4
	middle	3.7
	before	2.8
Height	behind	3
	fore cross-bar	4
	before	2.8
Opening behind, and at fore cross-bar		34
Two-shaft cross-bars	length	34
	breadth	2
	height	3
Under cross-bars	length	40
	breadth	3
	height	2
Side-pieces	length	100
	breadth	13
	height	3
Axle-tree passes through the side-pieces from the bottom		3
From the shaft to the beginning of the roof		6
Height of the roof		12
Sides	length	88
	breadth	10
	thickness	1
Roof-sides	length	88
	breadth	11
	thickness	1
Opening at the middle of the cross-bar		35
Opening before, and at the hind cross-bar.		25

The *iron-work* is as follows :

Side-bolts with screws	8
Cross-bolts with single keys	2
Double hinges for the short lids	6
Staples with keys and chains	4
Hinges for roof lids	2
Hasps, staples, and keys for ditto	3
Axle-tree pins with keys	2

Complete iron for shafts, wheels, and axle-trees. See TUMBREL and *Travelling*-CARRIAGE.

Sling-CARTS, are used to carry mortars or heavy guns from one place to another, at a small distance, but chiefly to transport guns from the water-side to the proof-place, and from thence back again; as also to convey artillery to the batteries in a fortification, &c. Their dimensions are as follow :

		inch.
Wheels height		60
Naves length		15.5
Diameter	body	14
	middle	16
	linch	12
Fellies	breadth	3.4
	height	5.5
Spokes	breadth	2
	thickness	3
Axle-tree length		77.5
Body	length	40.5
	breadth	5.
	height	5.5
Arms length		18.5
Diameter	body	5
	linch	4
Shafts total length		168
From the centre of the axle-tree to the fore end		144
Breadth	from the hind end to the cross-bar	7
	middle	5.5
	fore end	3.4
Opening	axle-tree & fore cross-bar	23
	middle	30
	before	24
Height of the shafts		3.6
Cross-bars	breadth	4
	thickness	2
Cheeks to support the roller	length below	28
	above	7
	height	9
	thickness	4
	interval	32
Diameter of the roller		7
From the centre of the axle-tree to the fore end		24

Iron-work of a Sling-CART, is as follows :

Cross-bars	2
Round-headed nails to fasten the cross-bars	4
Bolts with screws to fasten the cheeks	7
Wheels and shafts complete.	

CARTEL, in *military transactions*, an agreement between two states at war for the exchange of their prisoners of war.

CARTE-BLANCHE, in *military affairs*, signifies an unlimited power to act to the best of one's judgement. It likewise strictly means a blank paper; a paper to be filled up with such conditions as the person to whom it is sent thinks proper.

CARTOUCH, in *military affairs*, is a case of wood about 3 inches thick at bottom, bound about with marline, holding about 400 musket-balls, besides 8 or 10 iron balls of a pound each,

each, to be fired out of a howitzer, for the defence of a pass, &c. See Grape-Shot.

CARTRIDGE, a case of paper, parchment, or flannel, fitted to the bore of the piece, and holding exactly its proper charge. Musket and pistol cartridges are always made of strong paper, between 30 and 40 of which are made from 1 pound of powder, including their priming. Cannon and howitzer cartridges are sometimes made of parchment, though more generally of flannel: the charges they contain are adapted to the service they are intended for.

Cartridge-*box*, a case of wood, made in a circular form, to wear before the body of the soldier, holding 24 musket-ball cartridges in two rows: it is covered with leather, and worn upon a belt, both on duty, and on the day of battle. See Pouch.

CASCABEL, in *artillery*, is the very hinder most knob or button of the cannon, or the utmost part of the breech. See Cannon.

CASCANS, in *fortification*, holes in the form of wells, serving as entrances to galleries, or giving vent to the enemy's mines. See Countermine.

CASEMATE, in *fortification*, a vault, or arch of mason work, in that part of the flank of a bastion which is next the curtain, made to defend the ditch, and the face of the opposite bastion. See Fortification.

CASERNES, in *fortification*, are buildings for the soldiers of the garrison to live in; generally erected between the houses of fortified towns, and the rampart.

Case-*Shot*. See Shot, and Laboratory.

CASSINE, in *military history*, signifies a small house in the country, generally surrounded with a ditch: they are very convenient to post small parties in, where they will be sheltered from any sudden attack, and can even make head 'till the nearest detachments can come and relieve them.

CASSIONS, chests filled with shells, and placed under ground, and fired: they are generally made to contain from 4 to 20 loaded shells, according to the execution they are to do. Their effects are more tremendous than mines.

CASTING, in *founding guns*, implies the operation of running any sort of metal into a mould prepared for that purpose.

CASTLE, in *military affairs*, a fortified place, or strong hold, to defend a town or city from an enemy. Castles are for the most part no higher in antiquity than the Conquest; or rather about the middle of king Stephen's reign. Castles were erected in almost all parts of the kingdom, by the several contending parties; and each owner of a castle was a kind of petty prince, coining his own money, and exercising sovereign jurisdiction over his people. History informs us that 1017 castles were built in this reign.

CATAFROME. See Crane.

CATAFALCO, in *military architecture*, a scaffold of timber, decorated with sculpture, painting, &c. for supporting the coffin of a deceased hero, during the funeral solemnity.

CATAPULTA, in *military antiquity*, an engine contrived for the throwing of arrows, darts and stones, upon the enemy. Some of these engines were so large, and of such force, that they would throw stones, of an hundred weight. Josephus takes notice of the surprising effects of these engines, and says, that the stones thrown out of them beat down the battlements, knocked off the angles of the towers, and had force sufficient to level a very deep file of soldiers.

CATTUS, } in *ancient military history*, was
CATHOUSE, } a kind of covered shed, sometimes fixed on wheels, and similar to the *Vinea* and *Pluteus* of the ancients.

CAVALCADE, in *military history*, implies a pompous procession of horsemen, equipages, &c. by way of parade, to grace a triumph, public entry, or the like.

CAVALIER, in *fortification*, is a work generally raised within the body of the place, 10 or 12 feet higher than the rest of the works. Their most common situation is within the bastion, and made much in the same form: sometimes they are placed in the gorges, or on the middle of the curtain; they are then made in the form of a horse-shoe. See Fortification. Their use is to command all the adjacent works and country round about it: they are seldom or never made but when there is a hill or rising ground, which overlooks some of the works.

Trench-Cavalier, in the *attacks*, is an elevation which the besiegers make by means of earth or gabions, within half-way, or two thirds of the glacis, to discover, or to enfilade the covert way.

CAVALRY, in *military affairs*, that body of soldiers that serves and fights on horseback: under this denomination are included, viz.

Horse, that is, regiments or troops of horse. In England there are, the horse-guards, commonly called the *first and second troops of horse-guards*; the *first and second troops of grenadier-guards*; the *royal regiment of horse-guards*. And in Ireland there are four regiments of horse-guards. The first troop of horse was raised in 1660.

Dragoons, are likewise regiments of horse, but distinguished from the former by being obliged to fight both on foot and on horseback. In England there is the first, or king's regiment of dragoon-guards; the second, or queen's regiment of dragoon-guards; the third, or prince of Wales's regiment of dragoon-guards. Likewise, the first, or royal regiment of dragoons; the second, or royal North-British dragoons; the third, or king's own regiment of dragoons: besides, the royal Irish dragoons, Inniskilling regiment of dragoons, queen's regiment of dragoons, prince of Wales's regiment of dragoons, with 10 more regiments of dragoons. The first regiment of dragoons was raised in 1681.

Hunters. See LIGHT-HORSE.

Light-horse, are regiments of cavalry, mounted on light, swift horses, whose men are but small, and lightly accoutred. They were first raised in the last war, in 1757.

Hussars, generally Hungarian horse. Their uniform is a huge furred cap, adorned with a cock's feather; those of the officers, either with an eagle's or a heron's; a very short waistcoat, with a pair of breeches and stockings in one; short light boots, generally of red or yellow leather; with a curious doublet, having five rows of buttons, which hang loosely on the left shoulder. Their arms are a long crooked sabre, light carbines, and pistols. Before they begin an attack, they lay themselves so flat on the necks of their horses, that it is hardly possible to discover their force; but, being come within pistol-shot of the enemy, they raise themselves with such surprising quickness, and fall on with such vivacity, that it is very difficult for the troops to preserve their order. When a retreat is necessary, their horses have so much fire, and are so indefatigable, their equipage so light, and themselves such excellent horsemen, that no other cavalry can pretend to follow them: they leap over ditches, and swim over rivers, with a surprising facility. Most of the German powers have troops under this name, as also France.

CAVEATING, in *fencing*, implies a motion whereby a person in an instant brings his sword, which was presented to one side of his adversary, to the opposite side.

CAVIN, in *military affairs*, implies a natural hollow, sufficiently capacious to lodge a body of troops, and facilitate their approach to a place. If it be within musket-shot, it is a place of arms ready made, and serves for opening the trenches, free from the enemy's shot.

CAZEMATTE. See CASEMATE.

CAZEMATE, } in *fortification*, is a certain
CASEMATE, } retired place in the flank of a bastion, for the defence of the ditch, and the face of the opposite bastion; not used at present. It also implies a well, having several subterranean branches, which are extended when they suspect the enemy is forming a mine, 'till they hear the miners at work.

CAZERNS. See BARRACKS.

CENOTAPH, in *military history*, implies the empty tomb of a hero, or a monument erected to the honour of a person, without the body of the deceased being interred in or near it.

CENTRE, } in a *general sense*, signifies a
CENTER, } point equally distant from the extremities of a line, surface, or solid.

CENTRE *of a bastion*, is a point in the middle of the gorge of the bastion, from whence the capital line commences, and which is generally at the inner polygon of the figure.

CENTRE *of a battalion*, on parade, is the middle, where an interval is left for the colours; of an incampment, it is the main street; and on a march, is an interval for the baggage, &c.

CENTRE *of gravity*, in *military mechanics*, is that point about which the several parts of a body exactly balance each other in any situation.

CENTRE *of a conic-section*, is the point where all the diameters meet.

CENTRE *of an ellipsis*, is that point where the transverse and conjugate diameters intersect each other.

CENTRE *of motion*, is that point which remains at rest while all the other parts of the body move about it.

CENTRE *of percussion*, is that point in which the force of the stroke is the greatest possible. When the moving body revolves round a fixed point, the centre of percussion is the same with the centre of oscillation, and found by the same method: but when the body moves in a parallel direction, the centre of percussion is the same with the centre of gravity.

CENTINEL, } is a private soldier, from the
CENTRY, } guard, posted upon any spot of ground, to stand and watch carefully for the security of the said guard, or of any body of troops, or post, and to prevent any surprise from the enemy. All centinels are to be very vigilant on their posts; neither are they to sing, smoke, or suffer any noise to be made near them. They are not to sit down, lay their arms out of their hands, or sleep; but keep moving about their posts during the two hours they stand, if the weather will allow of it. No centry to move more than 50 paces to the right,

right, and as many to the left of his poſt, and let the weather be never ſo bad, he muſt not get under cover. No one to be allowed to go from his poſt without leave of his commanding officer; and, to prevent deſertion or marauding, the centries and vedettes muſt be charged to let no ſoldier paſs.

CENTINEL *perdu*, a ſoldier poſted near an enemy in ſome very dangerous poſt, where he is in perpetual danger of being loſt.

CENTRY-*box*, a ſort of wooden box, or hut, to ſhelter the centinel from the injuries of the weather; but, in fortifications made of maſonry, they are made of ſtone, in a circular form.

CENTURY, in a *military ſenſe*, means a hundred ſoldiers, who were employed in working the battering-ram.

CESSATION, or *ceſſation of arms*, in a *military figurative ſenſe*, means a truce, or the total abrogation of all military operations for a limited time.

CHACE *of a gun*, generally means the whole length of it. See CANNON.

CHAFFERY, that part of a foundery where the forges are placed for hammering iron into complete bars, and thereby bringing it to perfection.

*CHASSEURS. See HUNTERS.

CHAIN *for engineers*, is a ſort of wire chain divided into links of an equal length, made uſe of for ſetting out works on the ground, becauſe lines are apt to ſhrink and give way.

There are ſeveral ſorts of chains made uſe of in menſuration; as Mr. Rathbone's, of two perches in length; others one perch long; ſome of 1000 feet in length: but that which is moſt in uſe amongſt engineers is Mr. Gunter's, which is 4 poles long, and contains 100 links, each link being $7\frac{92}{100}$ inches in length.

CHAIN-*ſhot*. See SHOT.

CHALLENGE, a cartel, or invitation to a duel or other combat: it may with propriety be called a provocation, or ſummons to fight, when an affront in derogation of honour has been offered.

CHAMADE, in a *military ſenſe*, means a ſignal made by the enemy, either by beat of drum, or ſound of trumpet, when they have any matter to propoſe; ſuch as to bury their dead, &c. See PARLEY.

CHAMBER *of a cannon*, in *artillery*, that part of the bore of a cannon which receives the powder with which it is charged. See CANNON.

CHAMBER *of a mortar*, the ſpace where the powder lies, and generally of ſeveral forms and dimenſions, ſuch as the conic, ſpheric, cylindric, parabolic, and concave or bottled chambers. See MORTARS.

CHAMBER *of a mine*, that place where the charge of powder is lodged, to blow up the works over it. See MINE.

CHAMBER *of a battery*, is a place ſunk under ground for holding powder, loaded ſh[illegible] and fuzes, where they may be out of danger, and alſo preſerved from the rain.

CHANDELIERS, in *military affairs*, a kind of moveable parapet, conſiſting of wooden frames, on which faſcines are laid to cover the workmen when at work on the trenches. They are made of various ſorts and ſizes, according to the uſe they are for.

CHAPE, the metalline part put on the end of a ſcabbard, to prevent the point of the ſword from piercing through it.

CHARACTER, in a *general ſenſe*, implies any mark uſed for repreſenting either ideas or objects.

Military CHARACTERS, *Mathematical* CHARACTERS, are certain marks invented for avoiding prolixity, and more clearly conveying the thoughts of the learned in thoſe ſciences to beginners; the chief of which are as follow:

+ in algebra is the ſign of the real exiſtence of the quality it ſtands before, and is called an affirmative, or poſitive ſign. It is alſo the mark of addition, and ſignifies that the numbers or quantities on each ſide of it are added together; as, if you ſee $a+b$, or $3+5$, it implies that a is added to b, or 3 added to 5. It ſtands for the word *more* alſo. Thus $5+4+7$ is read 5 *more* 4, *more* 7, *equal to* 16. So alſo $a+b+c+d$, ſhews that a, b, c, and d, are to be added together.

— This is the note of negation, negative exiſtence, or non-entity. It is the ſign of ſubtraction, and ſignifies that the numbers or quantities which come after it, are to be taken from the numbers or quantities which ſtand before it. Thus $a+b-c$, ſhews, that the quantity c is to be taken from the ſum of a and b. It ſtands for the word *leſs* alſo. Thus $9-5$, is read 9 *leſs* 5, which is 4; and $b-9$, is b *leſs* 9, and ſhews that 9 is to be taken from the quantity b, &c.

N. B. That + ſignifies a *poſitive* or *affirmative* quantity, or *abſolute* number; but — ſignifies a *fictitious* or *negative* number or quantity. Thus -8, is 8 times leſs than nothing. So that any number or quantity with the ſign + being added to the ſame number or quantity with the ſign —, their ſum will be equal to nothing. Thus 8 added to -8 is equal to 0, but -8 taken from $+8$, is equal to 16.

$\times$ is the ſign of multiplication. It ſignifies *into*, or *multiplied by*; thus $4 \times 5 \times 3$, ſhews, that 4 is to be multiplied by, or into 5, and their product, by or into 3. So alſo $a \times b \times c \times d$, ſhews the continual multiplication of a, b, c, and d.

N. B. When quantities are placed one after another, without any ſign or character, it ſhews their multiplication. Thus $a\,b$ is $a \times b$, &c.

$\div$ is the mark of diviſion, and ſignifies that the numbers or quantities before it are to be divided by the numbers after it. Thus $a \div b$, means that a is to be divided by b; ſo $16 \div 4$, ſhews that 16 muſt be divided by 4. There is a better way of expreſſing diviſion, and which is more frequently uſed; and this is by placing the dividend at top, and the diviſer underneath it. Thus a divided by b, is placed $\frac{a}{b}$; alſo 16 divided by 4, thus $\frac{16}{4}$, &c.

$=$ are the ſigns of equality, and ſignify that the quantities and numbers on the one ſide of it are equal to the quantities and numbers on the other; as $a = b$, or $AB = CD$; that is, a is equal to b, and AB is equal to CD, &c.

$\surd$ is the ſign of radicality, and ſhews (according to the index of the power that is ſet over or after it) the ſquare, cube, or other root, is extracted, or is to be ſo, out of any quantity, as $\surd 16$, or $\surd^2\, 16$, or $\surd (2)\ 16$ is the ſquare root of 16. This character ſometimes affects ſeveral quantities, diſtinguiſhed by a line drawn over them thus, $\sqrt{b+d}$ denotes the ſquare root of the ſum of b and d. When any term or terms of any equation are wanting, they are generally ſupplied by one or more aſteriſms: thus in the equation.

$$\left.\begin{array}{l} y^2 + py + \frac{1}{4}p^2 + q \\ \quad - py - \frac{1}{2}p^2 \end{array}\right\} = 0,$$ the term py vaniſhing, is marked with an aſteriſm, as $y^2 * - \frac{1}{4}p^2 + q$.

$\sqrt[3]{\ }$ is the ſign of the cube root, and ſignifies the extraction of it, as in the ſquare root above.

$\div\!\!\div$ is the ſign of continued or geometrical proportion: thus, $a \div\!\!\div b \div\!\!\div c$, &c. are quantities in geometrical proportion: but geometrical proportion is better expreſſed by one and the ſame quantity, with the ſign after them. Thus a, aa, aaa, $aaaa$, or a^1, a^3, a^4, a^5, — &c. are quantities in geometrical proportion. So alſo 2, 4, 8, 16, 32, 64 $\div\!\!\div$, &c. and in continual proportion.

$::$ is the mark of geometrical proportion disjunct, and is uſually placed between two pair of equal ratio's; as $3 : 6 :: 4 : 8$, ſhews that 3 is to 6, as 4 to 8. Or $a : b :: d : e$, and are thus read, as a is to b, ſo is d to e, &c.

$>$ or $\sqsubset$ are ſigns of majority; thus, $a > b$ expreſſes that a is greater than b.

$<$ or $\sqsupset$ are ſigns of minority; and when we would denote that a is leſs than b, we write $a < b$, or $a \sqsupset b$, &c.

$\sqrt[3]{a \times b + c}$ ſignifies, that the product of a and b added to c is to have its cube root extracted. The ſame of the ſquare root.

$\sqrt{a \times b + c - d}$ ſhews, that after the quantity d is taken out of the product of a and b more the ſum of c, the remainder is to have its ſquare root extracted.

——— is often uſed to couple or link quantities together, for the better reading or underſtanding them. Beſides, they are differently expreſſed from what they are when it is wanting. Thus, $a \times b + c + d$ has quite a different ſignification from what it has with the daſh over it: thus, $a \times \overline{b + c + d}$; for $a \times \overline{b + c + d}$, ſignifies, that the quantity a is to be multiplied by the ſum of b, c, and d; whereas, without the daſh, it would ſignify only that the ſum of the quantities c and d is to be added to the product of a into b.

$\sqrt{m + \frac{bi}{4} + dd - c}$ ſignifies, that the quantity c is to be taken out of the ſquare root of $m + \frac{hh}{4} + dd$. But

$\sqrt{m + \frac{ib}{4}} + dd - c$ ſignifies, that only the ſquare root of $m + \frac{lb}{4}$ is to be extracted, and then the difference between the quantities $dd - c$ to be added to it. The ſame for the cube root.

$\pm$ ſignifies *more* or *leſs ſuch a quantity*, and is uſed often in extraction of roots, completing of ſquares, &c.

Artillery-CHARACTERS, moſt generally uſed, are as follow:

C. qr. lb. which ſignifies centners or hundreds of 112 pounds, *qr.* quarters of 28 pounds, *lb.* pounds. Thus a piece of artillery with 4 : 3 : 16, is 14 hundred, 3 quarters, and 16 pounds.

Pr. ſignifies pounder. Thus 24 *pr.* is a 24-pounder.

T. C. qr. lb. ſignifies tuns, centners, quarters, pounds; and 28 *lb.* is one quarter, 4 *qr.* is one centner, or 112 pounds, and 20 *C.* is one tun.

lb.

lb. oz. dr. means, pounds, ounces, and drams: 16 *dr.* is one ounce, and 16 *oz.* is one pound.

lb. oz. dwt. gr. is pounds, ounces, pennyweights, and grains; of which 24 *gr.* make one pennyweight, 20 *dwt.* make one ounce, and 12 *oz.* one pound of troy-weight.

CHARACTERS *in fire-works are these following.*

M Means meal-powder.
ə Corned powder.
θ Saltpetre.
Z Brimstone.
C Z Crude sulphur.
C + Charcoal.
C S Sea-coal.
B R Beech raspings.
S × Steel or iron filings.
B × Brass-dust.
G × Glass-dust.
T × Tanners dust.
C I Cast-iron.
C A Crude antimony.
⋇ Camphor.
A Y Yellow amber.
L S Lapis calaminaris.
⌢ Gum.
B L Lamp-black.
G I Ising-glass.
W Spirit of wine.
S T Spirit of turpentine.
P O Oil of spike.

CHARACTERS used in the arithmetic of infinites are dots over letters, denoting the character of an infinitesimal, or fluxion. Thus the first fluxions of x, y, z, being marked thus, $\dot{x}, \dot{y}, \dot{z}$; the second are $\ddot{x}, \ddot{y}, \ddot{z}$; and the third $\dddot{x}, \dddot{y}, \dddot{z}$.

Geographical CHARACTERS, are °, ′, ″, ‴, &c. which signify degrees, minutes, seconds, thirds. Thus 40°, 35′, 18″, 55‴, is read 40 degrees, 35 minutes, 18 seconds, 55 thirds. It is also used in the elevation of pieces of artillery.

CHARGE, in *gunnery*, implies the quantity of powder, shot, ball, shells, granadoes, &c. with which a gun, mortar, or howitzer, is loaded.

As pieces of artillery are of various denominations, and consequently made use of on several occasions, their charges thence must have many variations. I shall therefore endeavour to explain every kind of charge in the following tables, deducted from practice.

CHARGES *for heavy guns from a 42-pounder to a 3-pounder, both brass and iron, in proof, service, saluting, and ricochet.*

Natures	Proof		Service		Saluting	Ricochet
	Brass	Iron	Brass	Iron		
prs.	lb. oz.	lb. oz.	b. oz	b. oz	b. oz.	lb. oz.
42	31 8	25	14	12	10 4	3 4
32	26 12	21 8	10 10	9 4	8	2 14
24	21	18	8	8	6	2
18	18	15	6	8	4 8	1 12
12	12	12	4	4	3	1 6
9	9	9	3	3	2 8	1 4
6	6	6	2 8	2 8	2	1
3	3	3	1	1	12	6

CHARGES *for medium guns.*

	Proof		Service		Saluting	Ricochet
	Brass	Iron	Brass	Iron		
prs.	lb. oz.	lb. oz	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	18	18	8	8	4	1 12
12	9	9	3 8		2 8	1 4
6	6	6	2	2 4	1 4	12
3	3	3	1	1	14	8

CHARGES *for light guns.*

	Proof		Service		Saluting	Ricochet
	Brass	Iron	Brass	Iron		
prs.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	10	5	5		4	1 12
12	6		3		2 8	1 4
6	3		1 8		1 4	12
3	1 8	1 12	12		14	8

CHARGED *cylinder*, in *gunnery*, implies that part of the chace of a gun, which contains the powder and ball.

CHART, or *sea*-CHART, is a hydrographical map, or a projection of some part of the earth's superficies in plano, for the use of navigators and geographers.

Plane-CHART, is a representation of some part of the superficies of the terraqueous globe, in which the meridians are supposed parallel to each other, the parallels of latitude at equal distances, and consequently the degrees of latitude and longitude every where equal to each other.

CHART *of reduction*, is that where the meridians are represented by right lines, inclining towards each other: thence it appears by construction, that these charts must correct the errors of the plane ones. But since these

parallels

parallels should cut the meridians at right angles, and do not, they are defective, inasmuch as they exhibit the parallels inclined to the meridians.

Mercators-CHART, is that where the meridians are strait lines parallel to each other, and equidistant: these parallels are also strait lines, and parallel to each other; but the distance between increases from the equinoctial towards each pole, in the ratio of the secant of the latitude to the radius.

Globular-CHART, a meridional projection, wherein the distance of the eye from the plane of the meridian, upon which the projection is made, is supposed to be equal to the sine of the angle of 45°. This projection comes the nearest of all to the nature of the globe, because the meridians therein are placed at equal distances.

Chorographic-CHARTS, are descriptions of particular countries.

Heliographic-CHARTS, descriptions of the body of the sun, and of the maculæ or spots observed in it.

Selenographic-CHARTS, particular appearances of the spots of the moon, her appearance and maculæ.

CHASE *of a gun.* See CHACE.

To CHASE *the enemy*, means to march after them on horseback in full speed. To pursue a ship at sea.

CHAUSSE, or *Res de* CHAUSSE, an old expression for the level of the field, or the plain ground.

CHAUSSE-*traps*. See CRAWS-FEET.

CHEEKS *of a gun-carriage*. See CARRIAGE.

CHEEKS *of a mortar-bed*. See BED.

CHEEKS *of a waggon*. See WAGGON.

CHEMIN-*Couvert*. See COVERT-WAY.

CHEMIN *des rondes*, in *fortification*, a space between the rampart and low parapet under it, for the rounds to go about it.

CHEMISE, in *fortification*, a word almost out of use, the wall with which a bastion, or any other work of earth, is lined for its greater support and strength: or it is the solidity of the wall from the talus to the stone-row.

CHEMISTRY, the art of examining bodies, and of extracting from them any of their component parts.

CHEVALIER, in a *general sense*, signifies a knight or horseman.

CHEVALER, in the manege, is said of a horse when, in passing upon a walk or trot, his off fore leg crosses the near fore leg every second motion.

CHEVAUX-*de-frise*, in *fortification*, a large joist or piece of timber, about 5 or 6 inches square, and 10 or 12 feet in length; into the sides whereof are driven a great number of wooden pins, about 6 feet long, and 1½ inch diameter, crossing one another at right angles, and pointed with iron. They are used on numberless occasions, as to stop up the breaches, to secure the avenues of a camp from the inroads both of horse and foot. They are sometimes mounted on wheels, with artificial fires, to roll down in an assault, &c. They were first used at the siege of Groningen, in 1658.

CHEVRETTE, a kind of gin. Among the many inventions for raising guns or mortars into their carriages, this engine is very useful: it is made of two pieces of wood about 4 feet long, standing upright upon a third, which is square: they are about a foot asunder, and parallel; pierced with holes opposite one another, to hold a strong bolt of iron, which may be raised higher or lower at pleasure: it may be used with a hand-spike, which takes its poise over this bolt, to raise any thing by force.

CHOROGRAPHY, in *engineering*, is the art of making a drawing or map of a country, province, or district.

CIMETER, See SIMITAR.

CINQUAIN, in *ancient military history*, was an order of battle, to draw up 5 battalions, so that they may make 3 lines; that is, a van, main-body, and reserve. Supposing the 5 battalions to be in a line, the 2d and 4th advance and form the van, the 3d falls back and forms the rear, the 1st and 5th form the main body upon the same ground. Lastly, every battalion ought to have a squadron of horse on both the right and left wings. Any number of regiments, produced by multiplying by 5, may be drawn up in the same manner; as 10×5=50. 15×5=75. 20×5=100, &c.

CIRCUMVALLATION, or *line of circumvallation*, in *military affairs*, implies a fortification of earth, consisting of a parapet and trench, made round the town intended to be besieged, when any molestation is apprehended from parties of the enemy, which may march to relieve the place.

Before the attack of a place is begun, care is to be taken to have the most exact plan of it possible; and upon this, the line of circumvallation and the attack are projected. This line, being a fortification opposed to an enemy that may come from the open country to relieve the besieged, ought to have its defences directed against them; that is, so as to fire from

the

the town: and the besiegers are to be encamped behind this line, and between it and the place. The camp ought to be as much as possible out of the reach of the shot of the place; and the line of circumvallation, which is to be farther distant from the place than the camp, ought much more to be out of the reach of its artillery.

As cannon are never to be fired from the rear of the camp, this line should be upwards of 1200 fathoms from the place: we will suppose its distance fixed at 1400 fathoms from the covert way. The depth of the camp may be computed at about 30 fathom, and from the head of the camp to the line of circumvallation 120 fathoms, that the army may have room to draw up in order of battle at the head of the camp, behind the line. This distance, added to the 30 fathoms, makes 150 fathoms, which being added to the 1400, makes 1550 fathoms for the distance of the line of circumvallation from the covert-way. The top of this line is generally 12 feet broad, and 7 feet deep: the parapet runs quite round the top of it, and at certain distances is frequently strengthened with redouts and small forts; the base 18 feet wide, the height within 6, and on the outside 5 feet, with a banket of 3 feet wide, and 1½ high. See Contravallation, or Countervallation.

CIRCUS, in *military antiquity*, a very capacious building, of a round or oval form, erected by the ancients for exhibiting shews to the people.

CITADEL, is a fort with 4, 5, or 6 bastions, raised on the most advantageous ground about a city, the better to command it, and commonly divided from it by an esplanade, the better to hinder the approach of an enemy; so that the citadel defends the inhabitants if they continue in their duty, and punishes them if they revolt. Besiegers always attack the city first, that, being masters of it, they may cover themselves the better against the fire of the citadel. Its having bastions distinguishes it from a castle. Sometimes the citadel stands half within, and half without the ramparts of the place.

CIVIC-CROWN, among the ancient Romans, was a crown given to any soldier who had saved the life of a citizen. It was composed only of oaken-boughs, but accounted more honourable than any other.

CLARENCIEUX, the second king at arms, so called from the duke of Clarence, third son to king Edward III.

CLARIGATION, in *Roman antiquity*, a ceremony which always preceded a formal declaration of war, performed in this manner: the chief of the heralds went to the territory of the enemy; where, after some solemn prefatory indication, he, with a loud voice, intimated that he declared war against them for certain reasons specified, such as injury done to the Roman allies, or the like.

CLAYES. See Hurdles.

CLEAR. To clear the trenches. See Trenches.

CLOATHING. See Regimentals.

CLOY, or *to cloy guns*. See *To* Nail.

CLOUTS. See Axle-Tree.

CLY-MORE, a great two-handed sword, formerly in use among the highlanders, two inches broad, doubly edged; the length of the blade, 3 feet 7 inches; the handle, 14 inches; of a plain transverse guard, 1 foot; the weight, 6 pounds and a half. These swords were the original weapons of England, as appears by the figure of a soldier found among the ruins of London, after the great fire in 1666.

COFFERS, in *fortification*, a hollow lodgment sunk in the bottom of a dry ditch, from 6 to 7 feet deep, and from 16 to 18 feet broad, and the length of it, the whole breadth of the said ditch, from side to side. The besieged generally make use of these coffers to repulse the besiegers, when they attempt to pass the ditch: they are distinguished only by their length from *Caponiers*; and it differs from the traverse and gallery, in that these are made by the besiegers, and the coffer by the besieged. They are covered with joists, hurdles, and earth, raised 2 feet above the bottom of the ditch; which rising serves instead of a parapet, with loop-holes in it.

COFFRE. See Caisson.

COHORT, in *Roman antiquity*, a name given to part of the Roman legion, comprehending about 600 men.

COINS, in *gunnery*, are a kind of wedges to lay under the breech of a gun, to raise or depress the metal.

COLONEL, in *military affairs*, the commander in chief of a regiment, whether horse, foot, dragoons, or artillery, in England: but in France, Spain, and some other southern nations, the colonels of horse are called *Maîtres de Camp*; in Germany, and most northern nations, they are called *Ritmeesters*. Colonels of foot take place, and command one another, according to the seniority of their regiments, and not of their commissions; but those of horse, on the contrary, according to the dates of their commissions.

Colonel *of horse*, who is the first officer of the

the regiment; hence his attention ought to be given to keeping the regiment complete, to have it composed of both men and horses fit for the service, and to take particular care to have them well exercised and taught the different evolutions; to be able on all occasions to form themselves according to the ground, or manner in which they may attack or be attacked.

Colonel *of foot*, or *infantry*. His functions are more extensive than those of the cavalry, as the infantry are employed to more different purposes. They should understand something of fortification, and be well acquainted with field-engineering. He cannot be too careful to maintain union and harmony among his officers; and, to succeed in this, he must acquire their esteem and confidence, and make himself to be respected. The true way to succeed in this, is to keep up subordination with unalterable firmness; to do justice to every one, to employ all his credit to procure favours to the corps in general, and to the officers in particular.

Colonel *of dragoons* is nearly connected with that of horse, to which word I refer the reader.

Colonel *of artillery*. The commander of a battalion of artillery is one of the most laborious employments both in war and peace, requiring the greatest ability, application, and experience. He is supposed to be a very able mathematician and engineer, to be thoroughly acquainted with the power of artillery, to understand the attack and defence of fortifications in all the different branches; to be able on all occasions to form the artillery according to the ground or manner in which they may attack or be attacked; in short, he should be master of every thing belonging to that important corps.

Colonel *of engineers*, should be a very able mathematician and mechanic, master of fortification, in planning, constructing, attacking, and defending the same. See Engineer.

Lieutenant Colonel, is the second person in command of a regiment, and it is under his direction that the affairs of the regiment chiefly roll. He is to have great qualifications, answerable to the corps he has the honour to serve in.

COLOURS, in the *military art*, are large silk flags fixed on half pikes, and carried by the ensign: when a battalion is encamped, they are placed in its front; but in garrison they are lodged with the commanding officer.

The first standard, guidon, or colours of a regiment, is not to be carried on any guard but that of his Majesty, the Queen, Prince of Wales, or captain-general.

The size of the colours to be 6 feet 6 inches flying, and 6 feet deep on the pike. The length of the pike (spear and ferril included) to be 9 feet 10 inches. The cords and tassels of the whole to be crimson and gold mixed.

Camp-Colours, are a small sort placed on the right and left of the parade of a regiment when in the field: they are 18 inches square, and of the colour of the facing of the regiment, with the number of the regiment upon them. The poles to be 7 feet 6 inches long, except those of the quarter and rear-guards, which are to be 9 feet.

Colour-*guard*. See Guard.

COLUMN, in the *art of war*, a long, deep file of troops or baggage. The advantages and disadvantages of columns are so numerous, that I will only mention, that the column ought to be able to form near the enemy, and in such a position, as not to suffer much from the artillery; that their motions be swift, so as not to suffer much during the operation; and that the divisions, in short, which compose it, be so arranged as to afford each other a mutual defence and assistance, in case they should be attacked. Such are the principles that should guide, in forming of columns judiciously, and of freeing them from that multiplicity of inconveniences which make them liable to the most melancholy accidents.

COMMAND, in *military affairs*, generally called *the word of command*, are terms used by officers in exercise, or upon service.

COMMANDANT, is that person who has the command of a garrison, fort, castle, regiment, company, &c.

COMMANDING-*ground*, implies, in a *military sense*, a rising ground which overlooks every post, or strong place. There are, strictly speaking, three sorts of commanding grounds; namely,

Front Commanding-*ground*. Every height is called so, that lies opposite to the face of the post which plays upon its front.

Reverse Commanding-*ground*, an eminence which plays upon the rear of a post.

Enfilade Commanding-*ground*, or *Curtain* Commanding-*ground*, a high place, which, with its shot, scours all the length of a line, &c.

COMMANDERY, a certain benefice belonging to some military order.

COMMISSARY, in *military affairs*, is of various

various denominations, though generally a civil officer appointed to inspect the musters, stores and provisions for the army. In war-time their number is unlimited, but generally very numerous.

COMMISSARY-*general of the musters*, or *muster-master general*. He takes account of the strength of every regiment as often as he pleases; reviews them, sees the horse be well mounted, and all the men well armed and clothed. He receives and inspects the muster-rolls, and knows exactly the strength of the army.

COMMISSARY-*general of stores*, a civil officer in the artillery, who has the charge of all the stores, for which he is accountable to the office of ordnance. He is allowed various other commissaries, clerks, and conductors, especially in war-time.

COMMISSARY *of the train-horses*, a civil officer likewise of the artillery, who has the inspection of all horses belonging to the train, the hospital, and the bakery; having under him a number of conductors, drivers, &c.

COMMISSARY-*general of provisions*, has the charge of furnishing the army in the field with all sorts of provisions, forage, &c. by contract: he must be very vigilant and industrious, that they may never suffer want. He has under him various commissaries, store-keepers, clerks, &c.

COMMISSION, in a *military sense*, is the authority by which every officer acts in his post. All commissions are signed by the king, or by his general, if he be impowered.

COMMISSION *officers*. See OFFICERS.

COMMITTEE, a select number of persons to whom the more particular consideration of some matter is referred, and who are to report their opinion to the court, &c. of which they are members.

COMMUNICATION. See *Line of Communication*.

COMPANY, in a *military sense*, means a small body of foot or artillery, the number of which is never fixed, but generally from 45 to 110, commanded by a captain, a lieutenant, and an ensign, and sometimes by a first and second lieutenant, as in the artillery. A company has usually 2 serjeants, 3 or 4 corporals, and 2 drums. In the guards the companies consist of 80 men each.

Free COMPANY, is one of those corps commonly called irregular; is seldom or never under the same orders with the regular corps of the army, but for the most part acts like a detached army, either by itself, or in conjunction with some of its own kind; therefore their operations are properly considered under the title of the *petite guerre*.

Independent COMPANY, that which is not incorporated in a regiment. Two such companies generally belong to each regiment in England, who are to supply the regiments with recruits.

COMPLEMENT *of the curtain*, in *fortification*, is that part of the curtain which, being wanting, is the demi-gorge. See FORTIFICATION.

COMPLEMENT *of the line of defence*, the remainder of the line of defence, after you have taken away the angle of the flank. See FORTIFICATION.

COMPLEMENT *of the line of the army*. See HONOURS.

COMPLEMENT *from guards*. See HONOURS.

COMPOUND *motion*. See GUNNERY.

COMPTROLLER *of the artillery*, inspects the musters of the artillery, makes the pay-list, takes the account and remains of stores, and is accountable to the office of ordnance. This post is only in war-time.

CONGRESS, in *military and political affairs*, is an assembly of commissioners, deputies, envoys, &c. from several courts, meeting to agree on peace, or to concert matters for their common good.

CONDUCTORS, are assistants to the commissary of stores, to conduct depots, or magazines, from one place to another: they have also the care of the ammunition waggons in the field: they report to the commissary, and are under his command.

CONTACT, a touching, or the point or points where one body touches another.

CONTINGENT, something casual or uncertain, that may or may not happen.

CONTRAMURE, in *fortification*, is a wall built before another partition-wall to strengthen it, so that it may receive no damage from the adjacent buildings.

CONTRAVALLATION, in the *art military*, implies a line formed in the same manner as the line of circumvallation, to defend the besiegers against the enterprises of the garrison: so that the army, forming a siege, lies between the lines of circumvallation and contravallation. The trench of this line is towards the town, at the foot of the parapet, and is never made but when the garrison is numerous enough to harrass and interrupt the besiegers by sallies. This line is constructed in the rear of the camp, and by the same rule as the line of circumvallation, with this difference, that as it is only intended to resist a body of troops much inferior to a

force which might attack the circumvallation, so its parapet is not made so thick, nor the ditch so wide and deep; 6 feet is sufficient for the 1st, and the ditch 8 feet broad, and 5 feet deep.

Amongst the ancients this line was very common, but their garrisons were much stronger than ours; for, as the inhabitants of towns were then almost the only soldiers, there were commonly as many troops to defend a place, as there were inhabitants in it. The lines of circumvallation and contravallation are very ancient, examples of them being found in histories of the remotest antiquity. The author of the military history of *Louis le Grand* pretends, however, that *Cæsar* was the first inventor of them; but it appears from the chevalier de Follard's treatise on the method of attack and defence of places, used by the ancients, how little foundation there is for this opinion. This author asserts, with great probability on his side, that these lines are as ancient as the time in which towns were first surrounded with walls, or, in other words, fortified.

CONTRE *Queuë d'yronde* } See *Swallow's Tail.*
Queuë d'yronde }

CONTRIBUTION, in *military history*, is an imposition or tax paid by countries who suffer the fury of war, to redeem themselves from being plundered and totally destroyed by the enemy; or when a belligerent prince wants money, raises it by contribution on the enemy's country, and is either paid in provision or in money, and sometimes in both.

CONVERSION, is a military motion or manœuvre, which turns the front of a battalion where the flank was, when the flank is attacked.

CONVOY, in *military affairs*, a detachment of troops employed to guard any supply of men, money, ammunition, provisions, stores, &c. conveyed in time of war, by land or sea, to a town, army, or the like. A body of men that marches to secure any thing from falling into the enemy's hand, is also called a *Convoy*. An officer, having the command of a convoy, must take all possible precautions for its security; and endeavour, before its march, to procure some good intelligence concerning the enemy's out-parties: and as the commanding-officer of the place from which the convoy is to march, and those of such other places as he is to pass by, are the most proper persons to apply to for assistance; he must therefore take such measures as will enable him to keep up a constant intercourse with them. The conducting a convoy is one of the most important and most difficult of all military operations.

COPPER-*boats*. See Pontoons.

CORBEILLES. See Baskets.

CORDEAU, a line used by engineers, divided into fathoms, and feet, &c. to mark out works on the ground.

CORDON, in *fortification*, is a row of stones made round on the outside, and placed between the termination of the slope of the wall, and the parapet which stands perpendicular, in such a manner, that this difference may not be offensive to the eye; whence those cordons serve only as ornaments in walled fortifications.

Cordon, in *military history*, is an imaginary line of separation between two armies, either in the field or in winter-quarters.

CORIDOR. See Covert-way.

CORNET, in the *military history of the ancients*, an instrument much in the nature of a trumpet: when the cornet only sounded, the ensigns were to march alone without the soldiers; whereas, when the trumpet only sounded, the soldiers were to move forward without the ensigns.

Cornet, in the *military history of the moderns*, the third commission officer in a troop of horse or dragoons, subordinate to the captain and lieutenant, equivalent to the ensign amongst the foot. His duty is to carry the standard, near the centre of the front rank of the squadron.

CORNISH-*ring*, in *gunnery*, the next ring from the muzzle backwards. See Cannon.

CORPORAL, an inferior or non-commission officer of foot, under a serjeant, who has charge of one of the squads of a company, places and relieves centinels, and keeps good order in the guard. He receives the word of the inferior rounds that pass by his guard. Every company has 3 or 4 corporals.

Lance-Corporal, one who acts as corporal.

CORPS *de Garde*. See Guard.

Corps *de Battaille*. The main body of an army drawn up for battle, whereof the first line is called the van, the second the main body, and the third the body of reserve, or rear-guard. See Battle.

Corps *de Reserve*. See Rear-Guard.

CORSAIR, in *naval history*, a name given to the piratical cruisers of Barbary, who frequently plunder the merchant-ships of countries with whom they are at peace.

CORSELET, a little cuirass; or, according to others, an armour, or coat made to cover the whole body anciently worn by the pikemen, usually placed in the fronts and flanks of

the battle, for the better resisting the enemy's assaults, and guarding the soldiers placed behind them.

COSSACKS, in *military history*, a wild irregular people, who inhabit the Ukraine, and live by plunder and piracy, in small vessels on the Black Sea. A scythe fixed on the end of a pole was their ancient weapon. They are now a regular militia, and use the same arms as the Croats and Pandours.

COUNCIL *of war*, in *military affairs*, is an assembly of principal officers of an army or fleet, called by the general or admiral who commands, to concert measures for their conduct.

COUNTER-*forts*, in *fortification*, are certain pillars and parts of the wall, distant from 15 to 20 feet one from another, which advance themselves as much as may be in the ground, join themselves to the height of the cordon by vaults, to sustain the chemin de rondes, and the part of the rampart, to fortify the wall, and strengthen the ground.

COUNTERVALLATION, or *line of countervallation*, a trench with a parapet, made by the besiegers, betwixt them and the place besieged, to secure them from the sallies of the garrison; so that the troops which form the siege, are encamped between the lines of circumvallation and countervallation. When the enemy has no army in the field, these lines are useless.

COUNTERMARCH, in a *military sense*, is to march back again; a change of the wings and front of an army, battalion, or company, whereby the men in the front come to be in the rear.

COUP-*d'œil*, in *milit ry history*, implies, in battle, to throw an attacking army into disorder, or, by its succession of resource, drive away an opposition not formed adequate to repulse its attackers. *Coup-d'œil*, in *field fortification*, is, by irregular and detached works adapted to the ground, to form a complete systematical piece of fortification, though to a common eye disjointed and unconnected. So that this French word may not be improperly called a stratagem of war.

COURIER, in a *military sense*, means a messenger sent post, or express, to carry dispatches of battles gained, lost, &c. or any other occurrences that happen in war.

COURT-*martial*, a court appointed for the punishment of offences in officers, under-officers, soldiers, and sailors; the powers of which are regulated by the mutiny-bill, in the words, and to the effect following. His majesty may, from time to time, grant a commission, under his royal sign manual, to any officer, not under the degree of a field-officer, for the holding a general court-martial within this realm; and also grant his warrant to the lord lieutenant of Ireland, or other chief governor or governors there for the time being, or the governor or governors of Minorca, Gibraltar, and any of his majesty's dominions beyond the seas respectively, or the person or persons there commanding in chief, from time to time, to appoint courts-martial in the kingdom of Ireland, and other places and dominions respectively; in which courts-martial, all offences mentioned in the articles of war, and all other offences hereinafter specified, shall be tried and proceeded against in such manner as the act for that purpose directs. The courts have power by their sentence of judgment to inflict corporal punishment, not extending to life or limb, on any soldier, for immoralities, misbehaviour, or neglect of duty. A general court-martial shall not consist of a less number than 13, whereof none to be under the degree of a commission officer; and the president of such general court-martial shall neither be the commander in chief, or governor of the garrison where the offender shall be tried, nor under the degree of a field-officer, unless where a field-officer cannot be had; in which case the officer next in seniority, not being under the degree of a captain, shall preside at such court-martial; and that such court-martial shall have power and authority to administer an oath to every witness, in order to the examination or trial of any of the offences that shall come before them.

That in all trials of offenders by general courts-martial, to be held by virtue of this act, every officer present at such trial, before any proceedings be had thereupon, shall take the following oaths upon the holy evangelists, before the court and judge advocate, or his deputy (who are hereby authorized to administer the same) in these words,

"You shall well and truly try and determine according to your evidence, in the matter now before you, between our sovereign lord the king's majesty, and the prisoner to be tried:

"So help you God."

The oath. "I *A. B.* do swear, that I will duly administer justice according to the rules and articles for the better government of his majesty's forces, and according to an act of parliament now in force for the punishment of mutiny and desertion, and other crimes therein mentioned, without partiality, favour, or affection; and if

any doubt ſhall ariſe, which is not explained by the ſaid articles or act of parliament, according to my conſcience, the beſt of my underſtanding, and the cuſtom of war in the like caſes. And I further ſwear, that I will not divulge the ſentence of the court until it ſhall be approved by his majeſty, the general, or commander in chief; neither will I upon any account, at any time whatſoever, diſcloſe or diſcover the vote or opinion of any particular member of the court-martial, unleſs required to give evidence thereof, as a witneſs, by a court of juſtice in a due courſe of law.

" So help me God."

And as ſoon as the ſaid oaths ſhall have been adminiſtered to the reſpective members, the preſident of the court is hereby authoriſed and required to adminiſter to the judge advocate, or the perſon officiating as ſuch, an oath in the following words:

The oath. " I *A. B.* do ſwear, that I will not, upon any account, at any time whatſoever, diſcloſe or diſcover the vote or opinion of any particular member of the court-martial, unleſs required to give evidence thereof as a witneſs by a court of juſtice in a due courſe of law.

" So help me God."

And no ſentence of death ſhall be given againſt any offender in ſuch caſe by any general court-martial, unleſs 9 officers preſent ſhall concur therein; and if there be more officers preſent than 13, then the judgment ſhall paſs by the concurrence of two-thirds of the officers preſent; and no proceeding or trial ſhall be had upon any offence, but between the hours of 8 o'clock in the morning and 3 in the afternoon, except in caſes which require an immediate example.

Provided always, that the party tried by any general court-martial in the kingdom of Great-Britain or Ireland, or in Jerſey, Guernſey, Alderney, or Sark, or the iſlands thereto belonging, ſhall be intitled to a copy of the ſentence and proceedings of ſuch court-martial, upon demand thereof made by himſelf, or by any other perſon or perſons on his behalf (he or they paying reaſonably for the ſame) at any time not ſooner than 3 months after ſuch ſentence: and in caſe of trials by any general court-martial at Gibraltar or Minorca, at any time not ſooner than 6 months after the ſentence given by ſuch court-martial; and in caſe of trials by any general court-martial in his majeſty's other dominions beyond the ſeas, at any time not ſooner than 12 months after the ſentence given by ſuch court-martial, whether ſuch ſentences be approved or not; any thing in this act notwithſtanding.

Provided alſo, and be it enacted by the authority aforeſaid, that every judge advocate, or perſon officiating as ſuch, at any general court-martial, do, and he is hereby required to tranſmit, with as much expedition, as the opportunity of time and diſtance of place can admit, the original proceedings and ſentence of ſuch court-martial to the judge advocate general in London; which ſaid original proceedings and ſentence ſhall be carefully kept and preſerved in the office of ſuch judge advocate general, to the end that the perſons intitled thereto may be enabled, upon application to the ſaid office, to obtain copies thereof, according to the true intent and meaning of this act.

Provided always, and be it hereby declared and enacted, that no officer or ſoldier, being acquitted or convicted of any offence, be liable to be tried a ſecond time, by the ſame or any other court-martial, for the ſame offence, unleſs in caſe of an appeal from a regimental to a general court-martial; and that no ſentence given by any court-martial, and ſigned by the preſident thereof, be liable to be reviſed more than once.

COUP-DE-MAIN, in *military affairs*, implies a deſperate reſolution in all ſmall expeditions, of ſurpriſe, &c. The favourable ſide of the propoſed action muſt ever be viewed; for if what may happen, arrive, or fall out, is chiefly thought upon, it will, at the very beſt, greatly diſcourage, but, in general, it will end in a total failure. The very name of an expedition implies riſk, hazard, precarious warfare, and a critical but deſperate operation, or *Coup-de-main*.

COVERT-WAY, in *fortification*, is a ſpace of 5 or 6 fathoms on the border of the ditch towards the country, covered by a riſing ground, which has a gentle ſlope towards the field. This ſlope is called the glacis of the covert-way. See FORTIFICATION.

Second COVERT-WAY, or, as the French call it *avant-chemin couvert*, is the covert-way at the foot of the glacis. See FORTIFICATION.

COVER, in a *military ſenſe*, means that the files cover one another exactly. Troops are ſaid to be covered when poſted out of the danger of the enemy's fire.

COUNTER-*approaches*. See APPROACHES.

COUNTER-*battery*. See BATTERY.

COUNTER-*breaſtwork*. See FALSE-BRAY.

COUNTER-*forts*, in *fortification*, are certain pillars,

pillars, and parts of the wall of a fortification, at about 15 or 20 feet distance from each other, which are advanced as much as possible in the ground, and joined to the height of the cordon by vaults, to support the way of the rounds, and part of the ramparts; as also to fortify the wall, and strengthen the ground; generally used in large and strong fortifications.

COUNTER-*guards*, in *fortification*, are small ramparts, with parapets and ditches, to cover some part of the body of the place. They are of several shapes, and differently situated. They are generally made before the bastions, in order to cover the opposite flanks from being seen from the covert-way; consisting then of 2 faces, making a salient angle, and parallel to the faces of the bastion. They are sometimes made before the ravelins. See FORTIFICATION.

COUNTER-*round*. See ROUNDS.

COUNTER-*mine*. See MINES.

COUNTERSCARP, in *fortification*, is properly the exterior talus, or slope of the ditch, on the farther side from the place, and facing it. Sometimes the covert-way and glacis are meant by this expression. See FORTIFICATION.

COUNTER-*swallow's-tail*, in *fortification*, is a kind of an out-work very much resembling a single tenaille.

COUNTER-*march*. See MARCH.

To COUNTERMAND, is to give contrary orders to those already given, to contradict former orders, &c.

COUPURE, in *fortification*, are passages, sometimes cut through the glacis, of about 12 or 15 feet broad, in the re-entering angle of the covert-way, to facilitate the sallies of the besieged. They are sometimes made through the lower curtain, to let boats into a little haven built on the rentrant angle of the counterscarp of the out-works.

COURONEMENT, or *Couronnement*, in *fortification*, implies the most exterior part of a work when besieged.

CRAB. See GIN.

CRANE, an instrument made with ropes, pullies, and hooks, by which great weights are raised.

CREMAILLE, in *field fortification*, is when the inside line of the parapet is broken in such a manner as to resemble the teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defile, than if only a simple face was opposed to it; and consequently the passage is rendered more difficult.

Redouts en CREMAILLERE, or *Cremaille*, are such as are constructed as above mentioned.

CRETE, in *fortification*, implies the earth thrown out of the ditch in a fortification, trench, &c.

CROATS, in *military history*, light irregular troops so called; generally people of Croatia. They are commanded upon all desperate services, whose method of fighting is the same as the Pandours. They wear a short waistcoat, and long wide breeches, with light boots, and a cap greatly resembling the hussar cap. Their arms are a long firelock with rifled barrel, and short bayonet, a crooked hanger, and brace of pistols. The empress queen has 5000 of these troops, the greatest part of which have no pay, but live by plunder, at which they are remarkably dexterous.

CROWN-*work*, in *fortification*, an out-work that takes up more ground than any other. It consists of a large gorge, and two sides terminating towards the country in two demi-bastions, each of which is joined by a particular curtain, forming two half bastions and one whole one: they are made before the curtain, or the bastion, and generally serve to inclose some buildings which cannot be brought within the body of the place, or to cover the town gates, or else to occupy a spot of ground which might be advantageous to the enemy. See FORTIFICATION.

CROWNED *horn-work*, in *fortification*, is a horn-work, with a crown-work before it.

CROSS-*fire*, in *the art of war*, is when the fire of two or more adjoining sides of a field-redout, &c. crosses each other; frequently used in preventing an enemy's passing a defile. It may be two ways obtained: first, by constructing the redout with the face opposite to the defile, tenailled; that is, forming a re-entering angle. The other way is, to defend the defile by 2 redouts, whose faces command the passage, flanking each other at the same time.

CROSS-*bars*. See CARRIAGES.

CROWS-*feet*, in the *art of war*, are 4 pointed irons, so made, that what way soever they fall, one point is always uppermost. They are about 4 inches long, the short ones, and the long ones 6 or 7. The short ones are thrown on bridges, &c. and the long ones on the earth, both to incommode the cavalry, that they may not approach without great difficulty.

CROISADE } in *military history*, implies a
CRUSADE } holy war, or an expedition of the Christians against the Infidels for the recovery of the holy-land, and so called from those who engaged in it wearing a cross on their clothes.

CUBE, a solid, consisting of 6 equal square sides. The solidity of any cube is found by multiplying the superficial content of any one of the sides by the height. Cubes are to one another in the triplicate ratio of their diagonals.

CUBE-*root*, is the side of one of the squares constituting the cube. Thus, if the solidity of a cube be 64, the side of one of the squares, or cube-root, will be 4: because $4 \times 4 = 16$, the superficial content of the square, and $16 \times 4 = 64$, the solidity of the cube.

CUBIC *equation, in algebra*, is an equation whose highest power consists of three dimensions, as $x = a^3 - b^3$. See EQUATION.

CUBIC *foot*, implies so much as is contained in a cube whose side is 1 foot, or 12 inches.

CUBIC *hyperbola*, is a figure expressed by the equation $xy^2 = a$, having 2 asymptotes, and consisting of 2 hyperbolas, lying in the adjoining angles of the asymptotes, and not in the opposite angles, like the Apollonian hyperbola, being otherwise called, by Sir Isaac Newton, in his *enumeratio linearum tertii ordinis*, an hyperbolismus of a parabola; and is the 65th species of lines, according to him.

CUBIC *number*, is that which is produced by multiplying any number by itself, and then again the product by that number; as 27 is a cube number, since $3 \times 3 = 9 \times 3 = 27$. The difference of two cubic numbers, whose roots differ by unity, is equal to the aggregate of the square of the root of the greater, double the square of the less, and the less root.

CUBIC *parabola*, a curve of the second order, having infinite legs, tending contrary ways.

CUIRASSIERS, in the *military art*, are a sort of heavy cavalry armed with cuirasses, as most of the German horse are. The several German powers have regiments of cuirassiers, especially the emperor, and the king of Prussia. The king of France has also one regiment: but we have had none in the English army since the Revolution.

CUIRASSE, a piece of defensive armour, made of plate, well hammered, serving to cover the body, from the neck to the girdle, both before and behind, called breast and back-plate.

CULVERIN,
CULVERIN-*ordinary*,
CULVERIN *of the largest size*, } See CANNON.

CUNEUS. See WEDGE.

CUNETTE. See CUVETTE.

CURFEW-*bell*, in *military history*, a signal given in cities taken in war, &c. to the inhabitants to go to bed. The most eminent curfew in England, was that established by William the Conqueror, who appointed, under severe penalties, that, at the ringing of a bell, at 8 o'clock in the evening, every one should put out their lights and fires, and go to bed, &c.

CURTAIN, in *fortification*, is that part of the body of the place, which joins the flank of one bastion to that of the next. See FORTIFICATION.

Angle of the CURTAIN,
Complement of the CURTAIN, } See FORTIFICATION.

CUTLER, a *military artificer*, whose business is to forge, temper, and mount all sorts of sword-blades.

CYCLOPŒDIA. See ENCYCLOPOEDIA.

CYCLOID, in *geometry*, a curve generated in the following manner.

If a circle ABC (Pl. XII. fig. 6) resting on a right line AL, begin to revolve in the manner of a wheel, from A towards L, the point A will, by its two-fold motion, describe the curve $ACDJL$, while the circle makes one revolution from A to L.

This curve is called the cycloid; and from its formation it is evident, (1.) That the base of the cycloid AL is equal to the periphery of the generating circle ABC. (2.) That the axis of the cycloid FD is equal to the diameter of the said circle. (3.) That the part of the base KL is equal to the arch of the circle IK; (4.) therefore KF $(= ME = IG)$ is equal to the remaining arch IH, or GD. (5.) That the chord of the circle KI is perpendicular to the cycloid in the point I; and (6.) therefore the chord HI (being at right-angles with IK) is a tangent to the curve in the point I. (7.) The said tangent HI is parallel to the chord DG.

Parallel to EI draw ei indefinitely near; and In perpendicular thereto; then will the triangles DGE, DGF, Ini, be similar; and so we have $DE : DG :: DG : DF :: In : Ii$; consequently, the semi-cycloid $DIL = 2DF$, the diameter of the generating circle. Pl. XII. fig. 6.

CUVETTE, in *fortification*, is a small ditch of 10 or 12 feet broad, made in the middle of a large dry ditch, about 4 or 4½ feet deep, serving as a retrenchment to defend the ditch, or else to let water in, if it can be had in the time of a siege. See FORTIFICATION.

CYLINDER, or *concave cylinder of a gun*, is all the hollow length of the piece, or bore. See CANNON.

Charged CYLINDER, the chamber, or that part which receives the powder and ball. See CANNON.

Vacant CYLINDER, that part of the hollow or bore which remains empty when the piece is loaded.

CYMBAL, in *ancient military history*, a warlike musical instrument in use among the ancients, made of brass, not unlike our kettle-drums, and, as some think, in their form, but smaller.

CZAR, in *military history*, a title of honour assumed by the great dukes, or, as they are now stiled, emperors of Russia. This title is no doubt, by corruption, taken from *Cæsar*, emperor; and accordingly they bear an eagle, as the symbol of their empire. The first that bore this title was Basil, the son of Basilides, about the year 1470.

D

DAGGER, in *military affairs*, a short sword, or poignard, about 12 or 13 inches long, with a basket-hilt. It is not long since, that duelists fought with sword and dagger.

DAM. See DYKE.

DART, in *ancient military history*, implies a small kind of lance, thrown by the hand.

DAUPHIN, a title given to the eldest son of France, and heir presumptive to the crown, on account of the province of Dauphiny, which, in 1343, was given to Philip of Velois, on this condition, by Humbert, dauphin of the Viennois.

DEBENTURE, is a kind of warrant, given in the office of the board of ordnance, whereby the person whose name is therein specified, is intitled to receive such a sum of money as by former contract had been agreed on, whether wages, or otherwise. Debenture, in some of the acts of parliament, denotes a kind of bond or bill, first given in 1649, whereby the government is charged to pay the soldier, creditor, or his assigns, the money due on auditing the account of his arrears.

DECAGON, in *fortification*, is a polygon figure, having 10 sides, and as many angles; and if all the sides are equal, and all the angles, it is called a regular decagon, and may be inscribed in a circle. The sides of a regular decagon are, in power and length, equal to the greatest segment of an hexagon inscribed in the same circle, and cut in extreme and mean proportion. If A B (Plate xii. *fig.* 7.) be the side of a regular decagon inscribed in a circle, and it be continued out to C, so that B C$=$A D, then will A B:B C::B C:A C. Thence let r be the radius of the circle, and put AB$=x$, then became AB$\times$AC$=$BC^2, we have $x\times\overline{r\times x}=rr$; hence by completing the square, &c. we get $x=\sqrt{\frac{5}{2}-\frac{1}{2}}=r$, the side of the decagon inscribed in that circle.

DECAMPING, or *to decamp*, in *military affairs*, is the marching of an army or body of men from the ground where it before lay encamped. See CAMP.

DECANUS, in *Roman military history*, an officer who presided over ten other officers, and was head of the contubernium, or serjeant of a file of Roman soldiers.

DECIMATION, in *Roman military history*, a punishment inflicted upon such soldiers as quitted their post, or behaved themselves cowardly in the field. The names of all the guilty were put into an urn or helmet, and as many were drawn out as made the tenth part of the whole number; and these were put to the sword, and the others saved.

DECURIO, in *Roman military history*, a commander of ten men in the army, or chief of a decury.

DECURY, ten Roman soldiers ranged under one chief, or leader, called the Decurio.

DEFENCE, in *fortification*, are all sorts of works that cover and defend the opposite posts; as flanks, parapets, cazemettes, and fausse-brays. It is almost impossible to fix the miner to the face of a bastion, till the defences of the opposite one are ruined, that is, till the parapet of its flank is beaten down, and the cannon, in all parts that can fire upon that face which is attacked, are dismounted. See FORTIFICATION.

Line of DEFENCE, represents the flight of a musket-ball from the place where the musketeers stand, to scour the face of the bastion, and should never exceed the reach of a musket. It is either fichant or razant: the first is when

it is drawn from the angle of the curtain to the flanked angle; the last, when it is drawn from a point in the curtain, razing the face of the bastion.

Line of DEFENCE is the distance between the salient angle of the bastion, and the opposite flank; that is, it is the face produced to the flank. See FORTIFICATION.

DEFENCE *of rivers*, in *military affairs*, is a vigorous effort to prevent the enemy from passing; to prevent which, a careful and attentive officer will raise redouts, and if necessary join curtains thereto: he will place them as near the banks as possible, observing to cut a trench through the ground at the windings of the river, which may be favourable to the enemy, and place advanced redouts there, to prevent his having any ground fit to form on, &c. See RIVERS.

To be in a posture of DEFENCE, is to be provided to oppose an enemy, whether in regard to redouts, batteries, or in the open field.

DEFENSIVE-*War*. See WAR.

DEFILE, in *military affairs*, a strait narrow passage, or road, through which the troops cannot march, otherwise than in making a small front, and filing off; so that the enemy may take an opportunity to stop or harrass their march, and to charge them with so much the more advantage, because the rear cannot come up to the relief of the front.

To DEFILE, is to reduce divisions or platoons into a small front, in order to march through a defile; which is most conveniently done by facing to either the right or left, and then wheeling to either right or left, and marching through by files, &c.

DEFILING *a lodgement*. See ENFILADE.

DEGRADATION, in a *military life*, the act of depriving an officer for ever of his commission, rank, dignity, or degree of honour; and taking away, at the same time, title, badge, and every other privilege of an officer.

DEGREE. Though this term properly belongs to geometry, nevertheless it is very frequently used both in fortification, and gunnery. Hence it will not be improper to declare, that it is a division of a circle, including a 360th part of its circumference. Every circle is supposed to be divided into 360°, parts called degrees, and each degree into 60′, other parts, called minutes; each of these minutes being divided into 60″, each second into thirds, and so on.

DEHORS, in the *military art*, are all sorts of out-works in general, placed at some distance from the walls of a fortification, the better to secure the main places, and to protect the siege, &c. See FORTIFICATION.

DELINEATION. See DESIGNING.

DEMI-BASTION, is a work with only one face and one flank. See FORTIFICATION.

DEMI
CANNON, *lowest*,
CANNON, *ordinary*,
CULVERIN,
CULVERIN *of the* *largest sort*, *least size*, *eldest sort*.
See CANNON.

DEMI-LINE, in *fortification*, is a work placed before the curtain to cover it, and prevent the flanks from being discovered sideways: it is made of two faces, meeting in an outward angle. See FORTIFICATION.

DEMI-GORGE, in *fortification*, is half the gorge, or entrance into the bastion, not taken directly from angle to angle, where the bastion joins to the curtain, but from the angle of the flank to the centre of the bastion; or the angle the two curtains would make, by their prolongation. See FORTIFICATION.

DENSITY *of bodies*. See MOTION.

DEPOT, in the *military phrase*, signifies a particular place at the tail of the trenches, out of the reach of the cannon of the place, where the troops generally assemble, who are ordered either to attack the out-works, or support the troops in the trenches, when there is reason to imagine the besieged intend making a vigorous sally.

DEPOT, likewise means a temporary magazine for forage, for fascines, gabions, tools, and every other thing necessary for the support of an army, or for carrying on a siege.

DEPTH *of a battalion or squadron*, in *military affairs*, the number of ranks, or the quantity of men. Infantry were formerly drawn up 6 or 8 deep, that is, consisting of so many ranks; but now they are generally drawn up only 3 deep, and in the defence of a breast-work but 2 deep. When infantry is drawn up 3 deep, the first rank is called the front-rank; the second, the centre rank; and the third, the rear rank: and the files which bind the right and left, are called the flanks. The cavalry is generally drawn up 3 deep, and on some occasions only 2 deep.

DESCENT. See MOTION.

DESCENTS, in *fortification*, are the holes, vaults, and hollow places, made by undermining the ground.

DESCENT *into the ditch*, is a passage made through the esplanade and covert-way, in form

of

of a trench, the upper part of which is covered with madriers, and clays or hurdles, to secure the besiegers from the enemy's fire. In wet ditches this trench is on a level with the surface of the water, but in dry ones it is sunk as deep as the bottom of the ditch.

DESERTER, in a *military sense*, a soldier who, by running away from his regiment and company, abandons the service.

Penalty of DESERTION. All officers and soldiers, who having received pay, or having been duly inlisted in our service, shall be convicted of having deserted the same, shall suffer death, or such other punishment as by a court-martial shall be inflicted.

Any non-commissioned officer or soldier, who shall, without leave from his commanding-officer, absent himself from his troop or company, or from any detachment with which he shall be commanded, shall, upon being convicted thereof, be punished according to the nature of the offence, at the discretion of a court-martial.

No non-commissioned officer or soldier shall inlist himself in any other regiment, troop, or company, without a regular discharge from the regiment, troop, or company, in which he last served, on the penalty of being reputed a deserter, and suffering accordingly: and in case any officer shall knowingly receive and entertain such non-commissioned officer or soldier, or shall not, after his being discovered to be a deserter, immediately confine him, and give notice thereof to the corps in which he last served, he the said officer so offending shall by a court-martial be cashiered.

Whatsoever officer or soldier shall be convicted of having advised any other officer or soldier to desert our service, shall suffer such punishment as shall be inflicted upon him by the sentence of a court-martial.

Justices may commit DESERTERS. And whereas several soldiers, being duly listed, do afterwards desert, and are often found wandering, or otherwise absenting themselves illegally from his majesty's service; it is hereby further enacted, that it shall and may be lawful to and for the constable, headborough, or tythingman of the town and place, where any person, who may be reasonably suspected to be such a deserter, shall be found, to apprehend, or cause him to be apprehended, and to cause such person to be brought before any justice of the peace, living in or near such town or place, who hath hereby power to examine such suspected person: and if by his confession, or the testimony of one or more witness or witnesses upon oath, or by the knowledge of such justice of the peace, it shall appear, or be found, that such suspected person is a listed soldier, and should be with the troop or company to which he belongs; such justice of the peace shall forthwith cause him to be conveyed to the gaol of the country or place where he shall be found, or to the house of correction, or other public prison, in such town or place where such deserter shall be apprehended; or to the Savoy, in case such deserter shall be apprehended within the city of London or Westminster, or places adjacent; and transmit an account thereof to the secretary at war for the time being, to the end such person may be proceeded against according to law: and the keeper of such gaol, house of correction, or prison, shall receive the full subsistence of such deserter or deserters, during the time that he or they shall continue in his custody, for the maintenance of the said deserter or deserters; but shall not be intitled to any fee or reward, on account of the imprisonment of such deserter or deserters, any law, usage, or custom to the contrary notwithstanding.

Reward for taking up DESERTERS. And for the better encouragement of any person or persons to secure or apprehend such deserters as aforesaid; be it further enacted by the authority aforesaid, that such justice of the peace shall also issue his warrant in writing to the collector or collectors of the land-tax money of the parish or township where such deserter shall be apprehended, for paying, out of the land-tax money arising or to arise in the year 1778, into the hands of such person who shall apprehend, or cause to be apprehended, any deserter from his majesty's service, the sum of 20s. for every deserter that shall be so apprehended and committed; which sum of 20s. shall be satisfied by such collector, to whom such warrant shall be directed, and allowed upon his account.

Penalty for concealing DESERTERS, or *buying their arms, clothes*, &c. Provided always, that if any person shall harbour, conceal, or assist any deserter from his majesty's service, knowing him to be such, the person so offending shall forfeit, for every such offence, the sum of 5l. or if any person shall knowingly detain, buy, or exchange, or otherwise receive, any arms, clothes, caps, or other furniture belonging to the king, from any soldier or deserter, or any other person, upon any account or pretence whatsoever, or cause the colour of such

clothes to be changed; the perſon ſo offending, ſhall forfeit for every ſuch offence the ſum of 5l. and upon conviction by the oath of one or more credible witneſs or witneſſes, before any of his majeſty's juſtices of the peace, the ſaid reſpective penalties of 5l. and 5l. ſhall be levied by warrant under the hands of the ſaid juſtice or juſtices of the peace, by diſtreſs and ſale of the goods and chattles of the offender; one moiety of the ſaid firſt-mentioned penalty of 5l. to be paid to the informer, by whoſe means ſuch deſerter ſhall be apprehended; and one moiety of the ſaid laſt-mentioned penalty of 5l. to be paid to the informer; and the reſidue of the ſaid reſpective penalties to be paid to the officer to whom any ſuch deſerter or ſoldier did belong: and in caſe any ſuch offender, who ſhall be convicted, as aforeſaid, of harbouring or aſſiſting any ſuch deſerter or deſerters; or having knowingly received any arms, clothes, caps, or other furniture belonging to the king; or having cauſed the colour of ſuch clothes to be changed, contrary to the intent of this act, ſhall not have ſufficient goods and chattles, whereon diſtreſs may be made, to the value of the penalties recovered againſt him for ſuch offence, or ſhall not pay ſuch penalties within 4 days after ſuch conviction; then, and in ſuch caſe, ſuch juſtice of the peace ſhall and may, by warrant under his hand and ſeal, either commit ſuch offender to the common gaol, there to remain without bail or mainpriſe for the ſpace of three months, or cauſe ſuch offender to be publicly whipped, at the diſcretion of ſuch juſtice.

DESIGN, in a *general ſenſe*, implies the plan, order, repreſentation, or conſtruction of any kind of military building, chart, map, or drawing, &c. In building, the term *ichnography* may be uſed, when by deſign is only meant the plan of a building, or a flat figure drawn on paper: when ſome ſide or face of the building is raiſed from the ground, we may uſe the term *orthography*; and when both front and ſides are ſeen in perſpective, we may call it *ſcenography*.

DESIGNING, the art of delineating or drawing the appearance of natural objects, by lines on a plane.

DETACHED *pieces*, in *fortification*, are ſuch out-works as are detached, or at a diſtance from the body of the place; ſuch as halfmoons, ravelines, baſtions, &c.

DETACHMENT, in *military affairs*, an uncertain number of men drawn out from ſeveral regiments or companies equally, to march or be employed as the general may think proper, whether on an attack, at a ſiege, or in parties to ſcour the country. A detachment of 2000 or 3000 men is a command for a general officer; 800 for a colonel, 500 for a lieutenant-colonel, 200 or 300 for a major, 80 or 100 for a captain, 40 for a lieutenant or enſign, 12 for a ſerjeant, and 6 for a corporal. Detachments are ſometimes made of intire ſquadrons and battalions. One general rule, in all military projects that depend upon us alone, ſhould be to omit nothing that can inſure the ſucceſs of our detachment and deſign; but, in that which depends upon the enemy, to truſt ſomething to hazard.

DETAIL *of duty*, in *military affairs*, is a roſter or table for the regular and exact performance of duty, either in the field, garriſon, or cantonments. The general detail of duty is the proper care of the majors of brigade, who are guided by the roſter for the officers, and by the tables for the men, to be occaſionally furniſhed.

DEVASTATION, in *military hiſtory*, the act of deſtroying, laying waſte, demoliſhing or unpeopling towns, &c.

DIAMETER, in both a *military* and *geometrical ſenſe*, implies a right line paſſing through the centre of a circle, and terminating at each ſide by the circumference thereof. See CIRCLE.

The impoſſibility of expreſſing the exact proportion of the diameter of a circle to its circumference, by any received way of notation, and the abſolute neceſſity of having it as near the truth as poſſible, has put ſome of the moſt celebrated men in all ages upon endeavouring to approximate it. The firſt who attempted it with ſucceſs, was the celebrated Van Culen, a Dutch-man, who, by the ancient method, though ſo very laborious, carried it to 36 decimal places: theſe he ordered to be engraven on his tomb-ſtone, thinking he had ſet bounds to improvements. However, the indefatigable Mr. Abraham Sharp carried it to 75 places in decimals; and ſince that, the learned Mr. John Machin has carried it to 100 places, which are as follow:

If the diameter of a circle be 1, the circumference will be 3.1415926535,8979323846,2643383279,5028841971,6939937510,5820974944,5923078164,0528620899,8628034825,3421170679, + of the ſame parts; which is a degree of exactneſs far ſurpaſſing all imagination.

But the ratios generally uſed in the practice of

of military mathematics are these following. The diameter of the circle is to its circumference as 113 is to 355 nearly.—The square of the diameter is, to the area of the circle, as 452 to 355.—The cube of the diameter is, to the solid content of a sphere, as 678 to 355.—The cubes of the axes are, to the solid contents of equi-altitude cylinders, as 452 to 355.—The solid content of a sphere is, to the circumscribed cylinder, as 2 to 3—.

How to find the DIAMETER *of shot or shells.* For an iron ball, whose diameter is given, supposing a 9-pounder, which is nearly 4 inches, say, the cube root of 2.08 of 9 pounds is, to 4 inches, as the cube root of the given weight is to the diameter sought. Or, if 4 be divided by 2.08, the cube root of 9, the quotient 1.923 will be the diameter of a 1-pound shot; which being continually multiplied by the cube root of the given weight, gives the diameter required.

Or by logarithms much shorter, thus. If the logarithm of 1.923, which is .283979, be constantly added to the third part of the logarithm of the weight, the sum will be the logarithm of the diameter. Suppose a shot to weigh 24 pounds: add the given logarithm .283979 to the third part of .460070 of the logarithm 1.3802112 of 24, the sum .7440494 will be the logarithm of the diameter of a shot weighing 24 pounds, which is 5.5468 inches.

If the weight should be expressed by a fraction, the rule is still the same: for instance, the diameter of a 1½ pound ball, or $\frac{3}{2}$, is found by adding the logarithm .2839793, found above, to .0586971 $\frac{1}{3}$ of the logarithm of $\frac{3}{2}$, the sum .3426764 will be the logarithm of the diameter required, i. e. 2.2013 inches.

As the diameter of the bore, or the caliber of the piece, is made $\frac{1}{20}$ part larger than that of the shot, according to the present practice, the following table is computed.

DIAMETERS *of the shots and calibers of English guns.*

lb.	0	1	2	3	4	5	6	7	8	9	
0	0	1.923	2.423	2.775	3.053	3.288	3.498	3.679	3.846	4.000	Diam.
	0	2.019	2.544	2.913	3.204	3.568	3.668	3.861	4.038	4.200	Calib.
1	4.143	4.277	4.403	4.522	4.635	4.743	4.846	4.945	5.040	5.131	Diam.
	4.349	4.490	4.623	4.748	4.866	4.981	5.088	5.192	5.292	5.368	Calib.
2	5.220	5.305	5.388	5.409	5.547	5.623	5.697	5.769	5.839	5.908	Diam.
	5.480	5.570	5.661	5.742	5.824	5.893	5.982	6.057	6.129	6.203	Calib.
3	5.975	6.041	6.105	6.168	6.230	6.290	6.350	6.408	6.465	6.521	Diam.
	6.273	6.343	6.410	6.475	6.541	6.604	6.666	6.707	6.788	6.846	Calib.
4	6.576	6.631	6.684	6.737	6.789	6.640	6.890	6.940	6.989	7.037	Diam.
	6.904	6.962	7.018	7.076	7.128	7.182	7.234	7.287	7.338	7.383	Calib.

EXPLANATION.

The numbers in the first horizontal line are units, and those in the first vertical column tens; the other numbers, under the one, and opposite to the others, are the respective diameters of shot and calibers. Thus, to find the diameter of the shot, and the caliber of a 24-pounder, look for the number 2 on the left-hand side, and for 4 at top; then the number 5.547, under 4, and opposite 2, will be the diameter of the shot in inches and decimals, and the number 5.824, under the first, the caliber of a 24-pounder, &c.

DIAMETERS *of leaden bullets from 1 to 29 in the pound.*

	0	1	2	3	4	5	6	7	8	9
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.536	.526	.521	.517	.511	.506	.501	.497	.493

The diameters of muſket bores differ about 1-:oth part from that of the bullet. The government allows 11 bullets in the pound, for the proof of muſkets, and 14 in the pound, or 29 in 2 pounds, for ſervice; 17 for the proof of carbines, and 20 for ſervice; 28 in the pound for proof of piſtols, and 34 for ſervice.

DIAMETER *of powder meaſures.* See POWDER MEASURES.

DIGGING. See MINING.

DIKE. See DITCH. See FORTIFICATION.

DIMACHÆ, in *ancient military affairs*, were a kind of horſemen, anſwering to the dragoons of the moderns.

DIRECTION, in *military mechanics*, ſignifies the line or path of a body in motion, along which it endeavours to proceed, according to the force impreſſed upon it.

Angle of DIRECTION, that formed by the lines of direction of two conſpiring powers.

Quantity of DIRECTION, a term uſed by military mathematicians for the product of the velocity of the common centre of gravity of a ſyſtem of bodies, by the ſum of their quantities of matter: this is no ways altered by any colliſions among the bodies themſelves.

DIRK, a kind of dagger uſed by the highlanders in Scotland, which they generally wear ſtuck in their belts.

DISCHARGE, in a *military ſenſe*, is the diſmiſſing a ſoldier from the troop or company he belonged to, either by his own requeſt, or when, after long and faithful ſervices, he is diſcharged, and intitled to his majeſty's bounty.

DISCIPLINE, in a *general ſenſe*, ſignifies inſtruction and government.

Military DISCIPLINE. } By *military conſtitution*
Military conſtitution. } is meant, the authoritative declared laws for the guidance of all military men, and all military matters; and by *diſcipline* is meant, the obedience to, and exerciſe of, thoſe laws. As health is to the natural body, ſo is a ſound military conſtitution to the military one; and as exerciſe is to the firſt, ſo is diſcipline to the laſt. Bravery will perchance gain a battle; but every one knows it muſt be training and diſcipline that will, and muſt win the long-diſputed prize of a war.

The kingdom of Pruſſia is an example extant in favour of diſcipline; for ſince that ſtate has raiſed an army, and maintained that army in ſtrict diſcipline, it has held a very conſiderable ſhare in the ſyſtem of Europe; and ſhould it neglect its army, it will ſink from the kingdom of Pruſſia, into the electorate of Brandenburgh.

Marine DISCIPLINE, is the training up ſoldiers for ſea-ſervice, in ſuch exerciſes as the various poſitions of the firelock and body; and teaching them every manœuvre that can be performed on board ſhips of war at ſea, &c.

DISMOUNTING, in a *military ſenſe*, is the act of unhorſing. Thus, to diſmount the cavalry, &c. is to make them alight.

To DISMOUNT *cannon*, is to break their carriages, wheels, axle-trees, or any thing elſe, ſo as to render them unfit for ſervice. It alſo implies diſmounting by the gin, &c.

DISPART, in *gunnery*, is to ſet a mark on the muzzle-ring, ſo that it may be of an equal height with the baſe-ring: hence a line drawn between them, will be parallel to the axis of the concave cylinder, for the gunner to take aim by it, to hit the mark he is to fire at; for the bore and this imaginary line being parallel, the aim ſo taken muſt be true. This exactneſs cannot be made uſe of in an engagement, and but very ſeldom at a ſiege; for there practice and the eye muſt be the only guides.

DISPART-*frontlet.* See FRONTLET.

DISPOSITION, in a *military ſenſe*, is the juſt placing an army or body of men upon the moſt advantageous ground, and in the ſtrongeſt ſituation for a vigorous defence.

DISTANCE *of the baſtions*, in *fortification*, is the ſide of the exterior polygon. See FORTIFICATION.

DITCH. See FORTIFICATION.

To drain a DITCH, is to make the water run

off into lower ground, by means of small trenches cut for this purpose.

DIVERSION, in *military history*, is when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from making an irruption somewhere else. See STRATAGEMS.

DIVISIONS *of a battalion*, are the several platoons into which a regiment or battalion is divided, either in marching or firing; each of which is commanded by an officer.

DIVISIONS *of an army*, are the number of brigades and squadrons it contains.

DIVINE *service*, in the *army*, is or should be performed every Sunday by the chaplain of the regiment, not purely on a moral, but pretty much on a political account.—All officers and soldiers, not having just impediment, shall diligently frequent divine service and sermon, in the places appointed for the assembling of the regiment, troop, or company, to which they belong: such as wilfully absent themselves, or, being present, behave indecently or irreverently, shall, if commissioned officers, be brought before a court-martial, there to be publicly and severely reprimanded by the president: of non-commissioned officers or soldiers, every person so offending, shall, for his first offence, forfeit 12d. to be deducted out of his next pay; for the second offence, he shall not only forfeit 12d. but be laid in irons for 12 hours, &c. *Art. of war.*

DODECAGON, in *geometry*, is a regular polygon, consisting of 12 equal sides and angles, capable of being regularly fortified with the same number of bastions.

DOG-*nails*. See NAILS.

DOLPHINS. See CANNON.

DOSSER, in *military matters*, is a sort of basket, carried on the shoulders of men, used in carrying the earth from one part of a fortification to another, where it is wanted.

DOWLEDGES, DOWL-*bars*, DOWL-*pins*, } See CARRIAGES.

DOUBLE *tenaille*. See TENAILLE.

DOUBLING, in the *military art*, is the placing two or more ranks or files into one.

DOUBLE *your ranks*, is for the 2d, 4th, and 6th ranks (when so drawn up) to march into the 1st, 3d, and 5th; so that of 6 ranks they are made but 3; which is not so when they double by half-files, because then 3 ranks stand together, and the 3 other come up to double them; that is, the 1st, 2d, and 3d, are doubled by the 4th, 5th, and 6th, or the contrary.

DOUBLE *your files*, is for every other file to march into that which is next to it, on the right or left, as the word of command directs; and then the 6 ranks are doubled into 12, the men standing 12 deep; and the distance between the files is double what it was before. By this method 3 files may be doubled into 6, &c.

DRAGOONS, in *military affairs*, are a kind of horsemen, or cavalry, who serve both on horseback and foot; being always ready on every emergency, as being able to keep pace with the horse, and do the duty of foot. In battle, or on attacks, they generally fight sword in hand after the first fire. In the field they incamp on the right and left of the lines. They are divided into brigades, regiments, and squadrons. Their martial music is drums and trumpets. The first regiment of dragoons raised in England was in 1681, and called the royal regiment of dragoons of North Britain. This name is derived from the Latin word *Draconarii*, used amongst the Romans.

DRAG-*ropes*. See ROPES.

DRAUGHT-*hooks*, in a *gun-carriage*, are fixed to the transom-bolts on the cheeks of artillery carriages, near the trunnion-holes and trails: they are used to draw the guns backwards and forwards by men with drag-ropes fixed to those hooks. See CARRIAGE.

DRAW-*bridge*. See BRIDGE.

DRAWING, in a *military sense*, is the art of representing the appearances of all kinds of military objects by imitation, or copying, both with and without the assistance of mathematical rules.

DRAIN, or DREIN, in the *military art*, is a trench made to draw the water out of a ditch, which is afterwards filled with hurdles and earth, or with fascines, or bundles of rushes and planks, to facilitate the passage over the mud. See TRENCH.

DRESS-*military*. The clothing of the army is generally called regimentals, every part of which should facilitate, and not hinder, the various motions of the manual exercise. A soldier, without regard to fashion or taste, (to use the words of a modern author) should be dressed in the most comfortable and least embarrassing manner possible; and the keeping him warm, and leaving him the entire use of his limbs, are objects always to be had in view.

DRINKING to excess in the army is at all times highly criminal, but upon service is not to be pardoned; and the consequence will be a trial by a court-martial. It has been productive of almost innumerable mischiefs, and is a most detestable and horrid practice. What

ever

ever commissioned officer shall be found drunk on his guard, party or other duty, under arms, shall be cashiered for it; any non-commissioned officer or soldier, so offending, shall suffer such corporal punishment as shall be inflicted by the sentence of a court-martial. *Art. of war.*

DRUM, is a martial musical instrument in form of a cylinder, hollow within, and covered at the two ends with vellum, which is stretched or slackened at pleasure, by means of small cords and sliding leathers. This instrument is used both by foot and dragoons; which is done in several manners, either to give notice to the troops of what they are to do, or to demand liberty to make some proposal to an enemy. Every troop of dragoons, and every company of foot or artillery, has two or more drums, as the men are in number. The drum was first invented by Bacchus, who, as Polyenus reporteth, fighting against the Indians, gave the signal of battle with cymbals and drums; and the Saracens, who invaded Christendom, introduced the drum into the European armies. The various beats are as follow, viz.

The general, is to give notice to the troops that they are to march.

The assembly, } *The troop,* } is to order the troops to repair to the place of rendezvous, or to their colours.

The march, is to command them to move, always with the left foot first.

Tat-too, is to order all to retire to their quarters.

The reveille, is always beat at break of day, and is to warn the soldiers to rise, and the centinels to forbear challenging, and to give leave to come out of quarters.

To arms, is for soldiers who are dispersed, to repair to them.

The retreat, is a signal to draw off from the enemy.

Retraite, is always beat in both camp and garrison a little before sun-set, at which time the gates are shut, and the soldiers repair to their barracks.

The alarm, is to give notice of sudden danger, that all may be in readiness for immediate duty.

The parley, } *The chamade,* } is a signal to demand some conference with the enemy.

DRUM, or DRUMMER, the person who beats the drum.

Kettle-DRUMS, are two sorts of large basons of copper or brass, rounded at the bottom, and covered with vellum or goat-skin, which is kept fast by a circle of iron, and several holes fastened to the body of the drum, and a like number of screws to stretch it at pleasure. They are used among the horse. The *kettle-drum* belonging to the royal regiment of artillery is mounted on a most superb and pompous waggon, richly gilt and ornamented, and drawn by 4 white horses elegantly caparisoned, with a seat for the drum-major-general.

DRUM-*major,* is always that person in the regiment, who beats the best drum, has the command over the other drums, and teaches them their duty. Every regiment has a drum-major.

DUEL, is a single combat, at a time and place appointed, in consequence of a cartel or challenge. Duelling was anciently authorised; but the motive of the duellists was the good of their country, when one, or a small number of combatants were chosen to save the blood of a whole army, and decide, by victory or death, the quarrels of kings or nations. Thus it was with Goliah and David, the Horatii and Curatii, and several others.

DUELLING was so general a method of determining differences among the nobles, that even ecclesiastics were not excused; only, to prevent their being stained with blood, they procured champions to fight for them. None were excepted from combat, but sick people, cripples, and such as were under 21 years of age, or above 60. Justs and tournaments, doubtless, rendered duels more frequent.—No officer or soldier shall pretend to send a challenge to any other officer or soldier, to fight a duel, if a commissioned officer, on pain of being cashiered; if a non-commissioned officer or soldier, of suffering corporal punishment, at the discretion of a court-martial. *Art. of war.*

DUELLING was authorised before the Normans came into England, though not so frequent and solemn as after the conquest.

DUNGEON, } DONJON, } in *fortification,* is commonly a large tower or redout of a fortress, whither the garrison may retreat, in case of necessity, and capitulate with greater advantage.

DUTY, in a *military sense,* is the exercise of those functions that belong to a soldier; yet with this nice distinction, that duty is counted the mounting guard, &c. where no enemy is directly to be engaged; for when any body of men marches to meet the enemy, this is strictly called *going upon service.*

On

On all duties, whether with or without arms, picquets, or court-martials, the tour of duty begins with the eldest downwards. An officer who is upon duty cannot be ordered for any other before that duty is finished, except he be on the picquet, as then he shall be relieved, and go on that duty ordered.

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EAGLE. *Black*-EAGLE, an order of military knighthood in Prussia, instituted by the elector of Brandenbourg, in 1701, on his being crowned king of Prussia. The knights of this order wear an orange-coloured ribbon, suspending a black eagle.

White-EAGLE, is a like order in Poland, instituted in 1325, by Uladislaus V. on occasion of the marriage of his son Casimir to the daughter of the great duke of Lithuania. The knights of this order wear a chain of gold, suspending a silver eagle crowned.

EARTH-*bags*. See BAGS.

ECHARPE, in the *art military*. To batter *en echarpe*, is to fire obliquely, or sideways. See BATTERY.

ECHAUGETTE, in *military history*, signifies a watch-tower, or kind of centry box.

ECHO. See SOUND.

EDUCATION, in a *military sense*, implies the training up of youth to the art of war; wherein, first, should be understood, whether nature has given the young man the talents necessary for the profession or not; for here sense, parts, courage, and judgement, are required in a very eminent degree. The natural qualities of an officer, are, a robust constitution, a noble open countenance, a martial genius, fire to push action, phlegm to moderate his transports, and patience to support the toils and fatigues of war, without almost seeming to feel them. Birth and family, added to these advantages, never fail of commanding respect. Acquired qualities of an officer consist in moral virtues and sciences: by the first is meant, a regular good conduct, œconomy, prudence, and a serious application to what regards the service. Military sciences indispensably demand the reading of ancient and modern historians; a good knowledge of military mathematics, and the study of the chief languages of Europe.

It is in ancient authors we find all that is excellent, either in politics or war: the make and form of arms are changed since the invention of gun-powder; but the science of war is always the same. On one hand, history instructs us by examples, and furnishes us with proofs, of the beautiful maxims of virtue and wisdom, which morality has taught us: it gives us a kind of experience, before-hand, of what we are to do in the world; it teaches us to regulate our life, and conduct ourselves with wisdom; to distrust mankind; ever to carry ourselves with integrity and probity, never to do a mean action; and to measure grandeur with the level of reason, that we may despise it when dangerous or ridiculous.

On the other hand, history serves to give us a knowledge of the universe, and the different nations which inhabit it, their religions, their governments, their interests, their commerce, their politicks, and the law of nations. It shews us the origin of the illustrious houses who have reigned in the world, and given birth to those who still subsist.

The knowledge of military mathematicks, regards the operations of war in general; every thing there consists in proportion, measure, and motion: it treats of marches, encampments, battles, artillery, fortification, lines, sieges, mines, ammunition, provisions, fleets, and every thing which regards war; but no just notion can be acquired without geometry, natural philosophy, mechanics, military architecture, and the art of drawing.

The study of languages is most useful to an officer, and he feels the necessity of it, in proportion as he rises to higher employments. Thus the Latin, German, and French languages, are very necessary for an English officer; as the English, French, and Italian, are for a German.

EFFECTIVE *men*, in a *military sense*, are soldiers fit for service; as an army of 30,000 effective (fighting) men.

ELDER *battalion*. A battalion is counted elder than another, by the time since it was raised. See SENIORITY.

ELDER *officer*, is he whose commission bears the oldest date. See SENIORITY.

ELEVATION, in *gunnery*, that comprehended between the horizon and the line of direction of either cannon or mortar; or it is that which the chace of a piece, or the axis of its hollow cylinder, makes with the plane of the horizon.

EMBRASURE, in *fortification*, is an opening, hole, or aperture in a parapet, through which the cannon are pointed to fire at the enemy. They are generally made from 10 to 12 feet distant from one another, every one of them being from 6 to 9 feet wide without, and 2 or 2½ within: their height above the platform is 2½ or 3 feet towards the town, and 1½ foot on the other side towards the field, so that the muzzle of the piece may be sunk on occasion, and brought to fire low. See BATTERY. See FORTIFICATION.

EMINENCE, in the *military art*, a high or rising ground, which overlooks and commands the low places about it: such places, within cannon-shot of any fortified place, are a great disadvantage; for if the besiegers become masters of them, they can from thence fire into the place.

EMPATTEMENT, in *fortification*. See TALUS.

EMULATION, in a *military sense*, is a noble jealousy whereby gentlemen endeavour to surpass each other in the art of war, and military sciences. Is not the want of encouragement to excite emulation, the great cause of misconduct among military men? An officer who is not protected, who is never sure of the least favour, neglects himself, and takes less trouble to acquire glory, rarely heard of, though merited by the bravest actions, than to enjoy the tranquillity of an ordinary reputation. Brave actions, whoever are the authors, should never be buried in oblivion, as they excite emulation, and are full of instruction.

ENCAMPMENT, the pitching of a camp. See CAMP.

ENCEINTE, in *fortification*, is the interior wall or rampart which surrounds a place, sometimes composed of bastions or curtains, either faced or lined with brick or stone, or only made of earth. The *enceinte* is sometimes only flanked by round or square towers, which is called a Roman wall.

ENCOUNTERS, in *military affairs*, are combats, or fights, between two persons only. Figuratively, battles or attacks by small or large armies. The marquis de Feuquieres mentions four instances of particular encounters brought on by entire armies, with a design to create a general engagement, English edition, vol. 1. p. 304. &c.

ENEMY, in a *military sense*, one who is of an opposite side in war, or who publickly invades the kingdom.

ENFANS *perdus*, in *military history*, are soldiers detached from several regiments, or otherwise appointed to give the first onset in battle, or an attack upon the counterscarp, or the breach of a place besieged; so called (by the French) because of the imminent danger they are exposed to.

ENFILADE, in *fortification*, is used in speaking of trenches, or other places, which may be scoured by the enemy's shot, along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not *enfiladed* from any work of the place. See TRENCHES.

To ENFILADE, is to sweep the whole length of any work or line of troops with the shot of artillery or small arms.

ENGINES, in *military mechanics*, are compound machines, made of one or more mechanical powers, as levers, pullies, screws, &c. in order to raise, project, or sustain any weight, or produce any effect which could not be easily effected otherwise. Engines used in war are extremely numerous, as the battering-ram, ballista, waggons, chariots, &c.

ENGINE, *to drive fuzes*, consists of a wheel with a handle to it, to raise a certain weight, and to let it fall upon the driver, by which the strokes become more equal.

ENGINE *to draw fuzes*, has a screw fixed upon a three-legged stand, the bottom of which has a ring to place it upon the shell; and at the end of the screw is fixed a hand-screw by means of a collar, which being screwed on the fuze, by turning the upper screw, draws out or raises the fuze.

ENGINEER, is commonly applied to an officer who is appointed to inspect and contrive any attacks, defences, &c. of a fortified place, or to build or repair them, &c.

The art of fortification is an art which stands in need of so many others, and whose object is so extensive, and its operations accompanied with so many various circumstances, that it is almost impossible for a man to make himself master of it by experience alone, even supposing him born with all the advantages of genius and disposition possible for the knowledge

ledge and practice of that important art. We do not pretend to deny that experience is of greater efficacy than all the precepts in the world; but it has likewise its inconveniences as well as its advantages: its fruits are of slow growth; and whoever is content with pursuing only that method of instruction, seldom knows how to act upon emergencies of all kinds, because old age incapacitates him from exercising his employment. Experience teaches us, thro' the means of these errors we commit ourselves, what theory teaches us at the expence of others. The life of man being short, and opportunities of practice seldom happening, it is certain nothing less than a happy genius, a great share of theory, and intent application joined to experience, can make him one day shine in his profession. From whence it follows, that less than the three first of those four qualities, should not be a recommendation for the reception of a young gentleman into the corps of engineers.

The fundamental sciences, and those absolutely necessary, are arithmetic, geometry, mechanics, hydraulics, and drawing. Without arithmetic it is impossible to make a calculation of the extent, and to keep an account of the disbursements made, or to be made; nor without it can an exact computation be made upon any occasion whatsoever.

Without geometry it is impossible to lay down a plan or map with truth and exactness, or settle a draught of a fortification, or calculate the lines and angles, so as to make a just estimation, in order to trace them on the ground, and to measure the surface and solidity of their parts.

Mechanics teach us the proportions of the machines in use, and how to increase or diminish their powers as occasion may require; and likewise to judge whether those which our own imagination suggests to us, will answer in practice.

Hydraulics teach us how to conduct waters from one place to another, to keep them at a certain height, or to raise them higher.

How fluently soever we may express ourselves in speaking or writing, we can never give so perfect an idea as by an exact drawing: and often in fortification both are wanted; for which reason the art of drawing is indispensably necessary for engineers.

To the qualities above mentioned must be added activity and vigilance; both which are absolutely necessary in all operations of war; but especially in the attack of such places as are in expectation of succours. The besieged must have no time allowed them for consideration; one hour lost at such a juncture often proves irreparable. It is by their activity and vigilance that engineers often bring the besieged to capitulate, much sooner than they would have done if those engineers had not pushed on the attack with firmness and resolution. Want of vigilance and activity often proceed from irresolution, and that from weakness of capacity.

As the office of an engineer requires great natural qualifications, much knowledge, study, and application, it is but reasonable that the pay should be proportioned to that merit which is to be the qualification of the person employed: he must be at an extraordinary expence in his education, and afterwards for books and instruments for his instruction and improvement, as well as for many other things; and that he may be at liberty to pursue his studies with application, he must not be put to shifts for necessaries. It should likewise be considered, that if an engineer do his duty, be his station what it will, his fatigue must be very great; and, to dedicate himself wholly to that duty, he should be divested of all other cares.

The word Engineer is of modern date, and was first used about the year 1650, when one Capt. Thomas Rudd had the title of chief engineer to the king. In 1600 the title given to engineers was trench-master; and in 1622 Sir William Pelham, and after him Sir Francis Vere, acted as trench-masters in Flanders. In the year 1634 an engineer was called camp-master general, and sometimes engine-master, being always subordinate to the master of the ordnance.

At present the corps of engineers consists of
1 Colonel in chief;
2 Directors, or lieutenant-colonels;
4 Sub-directors, or majors;
12 Engineers in ordinary, or captains;
12 Engineers extraordinary, or captains;
14 Sub-engineers, or lieutenants;
24 Practitioner engineers, or second lieutenants; exclusive of the engineers on the Irish establishment, which are but few.

ENNEAGON, in *geometry*, or *fortification*, is a figure consisting of 9 angles, and as many sides, capable of being fortified with the same number of bastions.

ENSIGN, in the *military art*, a banner, under which the soldiers are ranged according to the different regiments they belong to. See COLOURS.

ENSIGN, or *ensign-bearer*, is an officer who carries

carries the colours, being the loweſt commiſſioned officer in a company of foot, ſubordinate to the captain and lieutenant. The word enſign is very ancient, being uſed both by the Greeks and Romans, and amongſt both foot and horſe. Enſigns belonging to the foot, were either the common one of the whole legion, or the particular ones of the manipuli. The common enſign of the whole legion was an eagle of gold or ſilver fixed on the top of a ſpear, holding a thunderbolt in her talons, as ready to deliver it. That this was not peculiar to the Romans, is evident from the teſtimony of Xenophon, who informs us, that the royal enſign of Cyrus was a golden eagle ſpread over a ſhield, and faſtened on a ſpear, and that the ſame was ſtill uſed by the Perſian kings. In the ruſtic age of Rome, the enſigns were nothing more than a wiſp of hay carried on a pole, as the word *manipulus* properly ſignifies. The enſign of the horſe was not ſolid, as the others, but a cloth, ſomewhat like our colours, ſpreading on a ſtaff; on which the names of the emperors were generally depicted. The religious care the ſoldiers took of the enſigns, was extraordinary: they worſhipped them, ſwore by them (as at preſent ſeveral European powers do) and incurred certain death if they loſt them. The Turks and Tartars make uſe of horſes tails for their enſigns, whoſe number diſtinguiſhes the rank of their commanders; for the Sultan has 7, and the Grand Vizier only 3, &c.

ENTERPRISE, in *military hiſtory*, an undertaking attended with ſome hazard and danger.

ENTERPRISER, an officer who undertakes or engages in any important and hazardous deſigns. This kind of ſervice frequently happens to the light-infantry, light-horſe, and huſſars.

ENVELOPE, in *fortification*, a work of earth, ſometimes in form of a ſingle parapet, and at others like a ſmall rampart: it is raiſed ſometimes in the ditch, and ſometimes beyond it. They are ſometimes *en zic-zac*, to incloſe a weak ground, where that is practicable, with ſingle lines, to ſave the great charge of hornworks, crown works, and tenailles, or where room is wanting for ſuch large works. Theſe ſorts of works are to be ſeen at Beſançon, Dovay, Luxembourg, &c. Envelopes in a ditch are ſometimes called ſillons, contre-gardes, conſerves, lunettes, &c. which words ſee.

EPAULE, in *fortification*, denotes the ſhoulder of a baſtion, or the place where its face and flank meet, and from the angle, called the angle of the ſhoulder. See FORTIFICATION.

EPAULEMENT, in *fortification*, is a kind of breaſt-work to cover the troops in front, and ſometimes in flank. In a ſiege, the beſiegers generally raiſe an epaulement of 8 or 10 feet high, near the entrance of the approaches, to cover the cavalry, which is placed there to ſupport the guard of the trenches. Theſe works are ſometimes made of filled gabions, or faſcines and earth. This term is frequently uſed for any work thrown up to defend the flank of a poſt, or any other place. See FORTIFICATION. It is ſometimes taken for a demi-baſtion, and at other times for a ſquare orillon to cover the cannon of the cazemate.

EPAULETTES, are a kind of ſhoulder-knots; thoſe for the ſoldiers, to be of the colour of the facing, with a narrow yellow or white tape round it, and worſted fringe; thoſe for the officers are made of gold or ſilver lace, with rich fringe. They are badges of diſtinction worn on one or both ſhoulders.

EPROUVETTE, is a machine to prove the ſtrength of gunpowder. They are of different ſorts, according to the fancy of different nations who uſe them. Some raiſe a weight, and others throw a ſhot, to certain heights and diſtances.

EPTAGON. See HEPTAGON.

EQUESTRIAN *ſtatue*, in *military hiſtory*, ſignifies the perſon of any great warrior mounted on horſeback.

EQUESTRIAN *order*, among the Romans, ſignified their knights or equites; as alſo their troopers or horſemen in the field; the firſt of which orders ſtood in contradiſtinction to the ſenators, as the laſt did to the foot: each of theſe diſtinctions was introduced into the ſtate by Romulus.

EQUIPAGE, in a *military ſenſe*, is all kinds of furniture made uſe of by the gentlemen of the army; ſuch as

Camp-EQUIPAGE, } are tents, kitchen-fur-
Field EQUIPAGE, } niture, ſaddle-horſes, baggage-waggons, bat-horſes, &c.

This kind is not determined in our ſervice, neither in regard to quantity or quality; but in the Pruſſian army is as follows, viz.

INFANTRY.

1. The field-marſhal general ſhall take into the field, one chaiſe or coach, with ſix horſes to draw it; 2 baggage waggons; 4 chaiſe-marines, and as many bat-horſes, mules, and ſaddle-horſes, as he pleaſes.

2. A general of foot, 1 chaiſe or coach with 6 horſes; 1 baggage-waggon; 3 chaiſe-marines;

rines; 12 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

3. A lieutenant-general, 1 chaiſe or chariot, with 4 horſes; 1 baggage-waggon; 8 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

4. A major-general, 1 chaiſe with four horſes; 1 baggage-waggon; 1 chaiſe marine; 6 bat-horſes, or mules; and 6 ſaddle-horſes.

5. A colonel, 1 chaiſe with 2 horſes, or 4 at moſt; 2 chaiſe-marines; 6 bat-horſes, or mules; and 4 ſaddle-horſes.

6. A lieutenant-colonel, 1 chaiſe, with 2 horſes; 1 chaiſe-marine; 4 bat-horſes, or mules; and 3 ſaddle-horſes.

7. A major, 1 chaiſe-marine; 4 bat-horſes, or mules; and 3 ſaddle-horſes.

8. A captain is only allowed 1 baggage-waggon for the company, 1 for himſelf, 1 bread-waggon, and 2 ſaddle-horſes.

9. No ſubaltern officer ſhall have a waggon, and is allowed only 1 bat-horſe, and 1 ſaddle-horſe.

N. B. All the chaiſe-marines are coloured alike, and the names of their reſpective regiments painted upon them; as alſo every general's name is painted in like manner upon the baggage-waggons and chaiſe-marines which belong to them.

CAVALRY.

1. A general of the horſe ſhall take into the field, 1 chaiſe or coach, with 6 horſes; 1 baggage-waggon; 3 chaiſe-marines; 12 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

2. A lieutenant-general, 1 chaiſe or chariot, with 4 horſes; 1 baggage-waggon; 2 chaiſe-marines; 8 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

3. A major-general, 1 chaiſe, with 4 horſes; 1 baggage-waggon; 1 chaiſe-marine; 6 bat-horſes, or mules; and 8 ſaddle-horſes.

4. A colonel, 1 chaiſe, with 2 horſes, or at moſt 4; 2 chaiſe-marines; 6 bat-horſes, or mules; and 6 ſaddle-horſes.

5. A lieutenant-colonel, ſhall take 1 chaiſe-marine; 4 bat-horſes, or mules; and 5 ſaddle-horſes.

6. A major, 1 chaiſe-marine; 4 bat-horſes, or mules; and 4 ſaddle-horſes.

7. A captain, 2 chaiſe-marines, 1 for his troop, and the other for himſelf; and 3 or 4 ſaddle-horſes.

8. The ſubaltern officers, 2 ſaddle-horſes, and 1 bat-horſe; but are poſitively not to have waggons; and all ſuch as are provided contrary to this regulation, ſhall be burnt.

N. B. The chaiſe-marines, and baggage-waggons ſhall be painted and coloured as above. The bat-horſes for the infantry, and troop-tents, are excluſive of theſe.

ESCALADE. See SCALADE.

ESCARPE, is the outward ſlope or talus of the rampart.

ESCORT, in the *art of war*. See CONVOY.

ESCOUADE. See SQUADS.

ESPADON, in old *military books*, a kind of two-handed ſword, having two edges, of a great length and breadth; formerly uſed by the Dutch.

ESPLANADE, in *fortification*, the ſloping of the parapet of the covert-way towards the field, and is therefore the ſame as the glacis of the counterſcarp; but begins to be antiquated in that ſenſe, and is now only taken for the empty ſpace between the glacis of a citadel, and the firſt houſes of the town.

ESPONTON. See SPONTOON.

ESPRINGAL, in the *ancient art of war*, a machine for throwing large darts, generally called muchettæ.

ESQUADE. See SQUADS.

ESSES, in the *train of artillery*, are fixed to draught-chains made in the form of an S, one end of which is faſtened to the chain, and the other to hook to the horſe's harneſs, or to a ſtaple: they ſerve likewiſe to lengthen and piece chains together.

ESTOILE. See STAR-REDOUT, STAR-FORT.

ETAPPE, a term uſed in military hiſtory, taken from the French; which ſignifies the quantity of proviſions and forage allowed in an army, in marching through a kingdom, whether going into winter-quarters, or taking the field.

ETAPPIER, in *military hiſtory*, is the perſon that contracts with the country or territory for furniſhing troops in their march with proviſions and forage, &c.

EVACUATE, in *military hiſtory*, a term made uſe of in the articles of capitulation granted to the beſieged at the time they ſurrender to the beſiegers; and is the ſame as quitting a place.

EVOLUTION, in the *art of war*, the motion made by a body of troops, when they are obliged to change their form and diſpoſition, in order to preſerve a poſt, occupy another, to attack an enemy with more advantage, or to be in a condition of defending themſelves the better. That evolution is beſt which, with a given number of men, may be executed in the leaſt

ſpace,

ſpace, and conſequently in the leaſt time poſſible.

Evolutions *of the moderns*, is a change of poſition, which has always for its object either offence or defence. The eſſentials in the performance of an evolution are, order, directneſs, and the greateſt poſſible rapidity. In ſhort, evolutions implies any body of troops marching to charge rapidly, and in good order; totally diſperſing, and forming with the utmoſt readineſs; wheeling in all its divisions; doubling in all ways; or, in other words, forming a column or columns from all points of its front.

Evolutions *of the ancients*, were their ready marching, wheeling, and forming into every poſition practiſed in thoſe days, &c.

EXAGON. See Hexagon.

EXECUTION, *Military* Execution, is the pillaging or plundering of a country by the enemy's army.

Military Execution, alſo means every kind of puniſhment inflicted on the army by the ſentence of a court-martial; which is of various kinds, ſuch as tying up to 3 halberts, and receiving a number of laſhes with a whip, compoſed of 9 whip-cord laſhes, and each laſh of 9 knots, from the drummer: or running the gantlope through the parade at guard-mounting, drawn up in 2 lines for that purpoſe; when the provoſt marches through with twigs or ſwitches, and every ſoldier takes as many as there are priſoners to be puniſhed: the priſoner then marches through the 2 lines, and each ſoldier gives him a hard ſtroke, the major riding up and down to ſee that the men lay on properly. When a ſoldier is to be puniſhed with death, a detachment of about 200 men from the regiment he belongs to forms the parade, when a file of grenadiers ſhoots the priſoner to death. N. B. Every nation has different methods of puniſhment.

EXERCISE, in *military affairs*, the practice of all thoſe motions and actions, together with the whole management of arms a ſoldier is to be perfect in, to render him fit for ſervice, and make him underſtand how to attack and defend, as exerciſe is the firſt part of the military art; and the more it is conſidered, the more eſſential it will appear. It frees their bodies from the ruſticity of ſimple nature, and forms men and horſes to all the evolutions of war. Upon it depend the honour, merit, appearance, ſtrength, and ſucceſs of a corps; while we ſee the greateſt armies, for want of being exerciſed, inſtantly diſordered, and that diſorder increaſing in ſpite of command: the confuſion overſets the art of ſkilful maſters, and the valour of the men only ſerves to precipitate the defeat: for which reaſon it is the duty of every officer to take care that the recruits be drilled as ſoon as they join their corps.

The greateſt advantage derived from the exerciſe, is the expertneſs with which men become capable of loading and firing, and their learning an attention to act in conformity with thoſe around them. It has always been lamented, that men have been brought on ſervice, without being informed of the uſes of the different manœuvres they have been practiſing; and that, having no ideas of any thing but the uniformity of the parade, they inſtantly fall into diſorder and confuſion when they loſe the ſtep, or ſee a deviation from the ſtrait lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention confined to ſhow, and ſo little given to inſtruct the troops in what may be of uſe to them on ſervice. Though the parade is the place to form the characters of ſoldiers, and teach them uniformity, yet being confined to that alone, is too limited and mechanical for a true military genius.

The great loſs that our troops ſuſtained in Germany, America, and the Weſt-Indies, during the laſt war, from ſickneſs, and not from the enemy, was chiefly owing to a neglect of exerciſe. An army, whoſe numbers vaniſh after the firſt 4 months of a campaign, may be very ready to give battle in their exiſting period; but the fact is, that although fighting is one part of a ſoldier's buſineſs, yet bearing fatigue, and being in health, is another, and at leaſt as eſſential as the firſt. A campaign may paſs without a battle; but no part of a campaign can be gone through without fatigue, without marches, without an expoſure to bad weather; all of which have exerciſe for their foundation; and if ſoldiers are untrained to theſe matters, and ſink under them, they are corporeally incapable of rendering much ſervice to their king and country.

It is not from numbers, or from inconſiderate valour, that we are to expect victory; in battle ſhe commonly follows capacity, and a knowledge of arms. We do not ſee that the Romans made uſe of any other means to conquer the world, than a continual practice of military exerciſes, an exact diſcipline in their camps, and a conſtant attention to cultivate the art of war. Hence, both ancients and moderns agree, that there is no other way to form good ſoldiers but by exerciſe and diſcipline; and it is by a continual practice and attention to this, that the Pruſſians have arrived at that

point

point of perfection so much admired in their evolutions, and manual exercise.

Infantry EXERCISE, *Manual* EXERCISE, as appointed by his majesty, consist in the words of command for that purpose. When a regiment is drawn up or paraded for exercise, the men are placed 3 deep, either by companies, or divided into platoons, with the grenadiers on the right; and in order to have the manual exercise well performed, it is in a particular manner requisite, that the ranks and files be even, well dressed, and the file-leaders well covered: this must be very strictly attended to both by the major, and his adjutant: all officers also, on service in general, where men are drawn up under arms, or without, must be careful that the ranks and files are exactly even; and the soldiers must learn to dress themselves at once, without the necessity of being directed to do it. The beauty of all exercise and marching consists in seeing a soldier carry his arms well, keep his firelock steady and even upon his shoulder, the right hand hanging down, and the whole body without constraint.——The firelocks, when shouldered, should be exactly dressed in rank and file; the men must keep their bodies upright, and in full front, not having one shoulder too forward, or the other too backward. The distances between the files must be equal, and not greater than from arm to arm, which gives the requisite room for the motions. The ranks are, or should be, 8 feet distant from each other. Every motion must be done with life, and all facings, wheelings, and marchings, performed with the greatest exactness. Hence a regiment should never be under arms longer than 2 hours. See MANOEUVRES, REGIMENT, FIRINGS.

Cavalry EXERCISE, is of two sorts, on horseback, and on foot. The squadrons for exercise are sometimes drawn up 3 deep, though frequently but 2 deep; the tallest men and horses in the front, and so on. When a regiment is formed in squadrons, the distance of 24 feet, as a common interval, is always to be left between the ranks; and the files must keep boot-top to boot-top. The officers commanding squadrons must, above all things, be careful to form with great celerity, and, during the whole time of exercise, to preserve their given distances. In all wheelings, the flank which wheels, must come about in full gallop. The men must keep a steady seat upon their horses, and have their stirrups at a fit length, to make a large and sure stroke with their sword in time of action.

Artillery EXERCISE, is the method of teaching the regiments of artillery the use and practice of all the various machines of war, viz.

EXERCISE *of the light field-pieces*, teaches the men to load, ram, and sponge the guns well; to elevate them, according to the distance, by the quadrant and screw; to judge of distances and elevations without the quadrant; how to use the port-fire, match, and tubes for quick firing; how to fix the drag-ropes, and use them in advancing, retreating, and wheeling with the field-pieces; how to fix and unfix the trail of the carriage on the limbers, and how to fix and unfix the boxes for grape-shot on the carriages of each piece.

EXERCISE *of the garrison and battering artillery*, is to teach the men how to load, ram, and spunge; how to handle the hand-spikes in elevating and depressing the metal to given distances, and for ricochet; how to adjust the coins, and work the gun to its proper place; and how to point and fire with exactness, &c.

Mortar EXERCISE, is of 2 different sorts, viz. with powder and shells unloaded, and with powder and shells loaded; each of which is to teach the men their duty, and to make them handy in using the implements for loading, pointing, traversing, and firing, &c. See PRACTICE.

Howitz EXERCISE, differs but little from the mortar, excepting its being liable to various elevations; whereas that of the mortar is fixed to an angle of 45°: but the men should be taught the method of ricochet-firing, and how to use them for grape-shot, &c. See PRACTICE.

EXERCISES, are also understood of what young gentlemen or cadets learn in the military academies and riding-schools; such as fencing, dancing, riding, the manual exercise, &c.

EXPEDITIONS, in a *military sense*, implies quickness, applied to time, motion, marching, or attacking an enemy, &c. An expedition is in some measure like a battle; requires quick resolves, and rapid execution: it is out of the nature of the thing itself to lay down fixed rules for the minute conducting of small expeditions; their first principles only can be with certainty fixed, and men will often disagree about preparations, and differ in their conduct, though they acknowledge the same principles.

One of the principles of many small expeditions, is surprise; and 6 battalions, without much accompanyment, may sometimes do that which 24, and a great fleet, would not succeed in.

There is no part of war so interesting to an

insulary soldier as an expedition; nor can there be any part more worthy of attention.

EXPEDITIONS hitherto have had no rules laid down for their conduct, and that part of war has never been reduced to a system. The slow rules of a great war will not do in expeditions; the stroke must be struck with surprise, and affright have dominion before succours come. Debate is out of season, and all slow proceedings are ruin. Not to advance, is to recede; and not to be on the road to conquest, is to be already conquered. There must be that glance, which sees certainly, though instantly; that rapidity, which executes on the surest rules, when it seems least to act on any.

In all small expeditions, such as expeditions of surprise, or *coups-de-main*, the favourable side of the proposed action must ever be viewed; for if what may happen, what may arrive, what may fall out, is chiefly thought upon, it will, at the very best, greatly discourage, but in general end in a total failure. Hence the very name of an expedition implies risk, hazard, precarious warfare, and a critical operation.

An expedition implies five things.

1st, A secrecy, if possible, of preparation, and concealment of design, &c.

2dly, That the means bear proportion to the end. In this there will ever be a difference in opinion.

3dly, A knowledge of the state and situation of the country, where the scene of action is, or the place or object that is to be attacked.

4thly, A commander who has the particular turn of mind, which is most adapted to such particular sort of warfare.

Lastly, The plan of an expedition, great or small, is ever to be arranged as much as possible before setting out, and then any appearances that may vary a little from what might have been expected, will not perplex.

EXPERIMENTS, in a *military sense*, are the trials, results, or effects, of the applications of any kind of military machines, in order to discover their effects or motions, and relations, whereby to ascertain some of their real uses, or causes, &c. See PRACTICE.

EYE-*bolts*. See BOLTS.

F

FAÇADE, in *military fortification*. See FACE.

FACE, in *fortification*, is an appellation given to several parts of a fortress; as the

FACE *of a bastion*, the two front sides, reaching from the flanks to the salient angle of the bastion. See FORTIFICATION.

Prolonged FACE, that part of the line of defence razant, which is between the angle of the shoulder, and the curtain, or the line of defence razant, diminished by the length of the face of the bastion. See FORTIFICATION.

FACE *of a place*, is the front comprehended between the flanked angles of two neighbouring bastions, composed of a curtain, two flanks, and two faces; and is sometimes called the *Tenaille of the place*.

FACE *of a gun*, is the superficies of the metal at the extremities of the muzzle of the piece.

FACE, in *tactics*, a word of command in the manual exercise of troops, intimating to turn about: thus,

FACE *to the right*, is to turn upon both heels a quarter-round to the right.

FACE *to the left*, is to turn upon both heels a quarter-round to the left. The same takes place with the cavalry, &c.

FAGGOTS, in *military history*, are men hired to muster by officers whose companies are not complete, to cheat the sovereign of so many men's pay.

FAGGOTS. See FASCINES.

FALCON, or *Faucon*, an ancient name given to a 3-pounder. See CANNON.

FALCONET, an ancient name given to a $1\frac{1}{2}$-pounder. See CANNON.

FALSE *attack*. See ATTACK.

FALSE *alarm*. See ALARM.

FANION, or *Fannon*. See BANNER.

FASCINES, in *fortification*, are a kind of faggots, made of small branches of trees or brush-wood, tied in 3, 4, 5 or 6 places, and are of various dimensions, according to the purposes intended. Those that are to be pitched over, for burning lodgments, galleries, or any other works of the enemy, should be $1\frac{1}{4}$ or 2 feet long. Those that are for making epaulements or chandeliers, or to raise works, or fill up ditches, are 10 feet long, and 1 or $1\frac{1}{4}$ feet in diameter. They are made as follows: six

six small pickets are struck into the ground, 2 and 2, forming little crosses, well fastened in the middle with willow bindings. On these trestles the branches are laid, and are bound round with withes at the distance of every 2 feet. Six men are employed in making a fascine; 2 cut the boughs, 2 gather them, and the remaining 2 bind them. These 6 men can make 12 fascines every hour. Each fascine requires five pickets to fasten it.

FATHOM, in *fortification*, did originally denote that space a man can reach when both his arms are extended; but now means a measure of 6 feet or 2 yards, equivalent to the French word toise.

FAUCON. See FALCON.

FAUCONET. See FALCONET.

FAUSSE-BRAY, in *fortification*, is a low rampart going quite round the body of the place: their height is about 3 feet above the level ground, and its parapet about 3 or 4 toises from that of the body of the place. These works have been entirely rejected by the modern engineers, excepting M. Vauban, who makes them only before the curtains; and then they are called more properly tenailles.

FELLIES, in *artillery*, are the parts of a wheel which form its circumference, whose dimensions are as follow: for a 24-pounder, 5 inches thick, and 6.5 inches broad; for a 12-pounder, 4.5 inches thick, and 6 inches broad; for a 6-pounder, 4 inches thick, and 5.5 inches broad, &c. made of dry elm. There are generally 6 in each wheel. See WHEEL.

FENCING, in the *military art*, is that of making a proper use of the sword, as well for attacking an enemy, as for defending one's self. Fencing is a genteel exercise, of which no military gentleman should be ignorant. It is learned by practising with steel foils. See FOILS.

Fencing is either simple, or compound. Simple is that performed nimbly, and off-hand, on the same line. In this the principal intention, in respect to the offensive part, should be to attack the enemy in the most unguarded part; and in the defensive, to parry or ward off the enemy's thrusts or blows.

Guard, in FENCING, implies a posture proper to defend the body from the sword of the antagonist, and is of various denominations.

Attitude, in FENCING, the head upright, though the body hath a forward inclination on a longe, and all the weight resting on the left haunch when on guard. The feet, hand, body, arm and sword, must be to the line.

Appels, in FENCING, is a sudden beat of your blade, on the contrary side to that you join your adversary on, and a quick disengagement to that side again.

Beating, in FENCING, is when you parry with a sudden short beat, to get a quick repost; or when you beat with your foot, to try if you are firm on it, or on both feet.

Battering, in FENCING, is to hit your adversary's blade on the side opposite to that you join, &c.

Back-quarte, is a parade of a late invention, and is a round quarte over the arm.

Cave, in FENCING, is a tierce on a quarte side, also the thrust of a prime, or a second, at the low quarte side.

Darting, in FENCING, to defend a blow with some contraction of your arm, and to dart a thrust right forward.

Faint forward, in FENCING, made by advancing your point a little from its line, and coming to it again.

Guard, in FENCING, is any of the parades you stand on.

On guard, is being placed on your feet, and well covered with your weapon.

Hanging guard, is one of the backsword guards, in form of second.

Inside guard, one of the backsword guards, in form of a quarte.

Lurching, in FENCING, to make an opening, to invite your adversary to thrust at you, when you, being ready, may find a favourable repost at him.

Locking, in FENCING, is to seize your adversary's sword arm by twining your left arm round it, after you close your parade, shell to shell, in order to disarm him.

Guard in { *carte*, *tierce*, *quatre*, } implies the putting of the body and sword in such a state of defence, as to prevent the antagonist from wounding you.

Thrust in FENCING, the thrust *in carte*, is to throw your hand as far as you can inside, with the point of your sword towards your adversary's breast. *To thrust seconde*, is to have your arm in a perfect opposition to your adversary's, holding your head inside. *To thrust tierce*, differs from carte only, by the position of the hand, which must be reversed.

Parrying, in FENCING, the action of warding off the blows aimed at each other.

Flanconade, in FENCING, is the action of dropping the point of your sword under your adversary's hilt, in seizing with force the feeble of his blade; which binding, without quitting it, form

form the parade in octave, and then throw in your thrust.

Glizade, in Fencing, is performed by dexterously making your sword slip along your adversary's blade, and forming at the same time your extension, &c.

FEU *de joie*. See Running-Fire.

FICHANT. See Line of Defence, Fortification.

FIELD-	*Colours,*	See	*Camp-colours.*
	Officers,		*Officers.*
	Pieces,		*Cannon.*
	Staff,		*Lintstock.*
	Works,		*Field-fortification.*

Field-*marshal*, a modern military rank in England, but superior to all others; having the chief command of the whole army.

FIGHT. See Battle.

FIGURE, in *fortification*, the plan of any fortified place, or the interior polygon. Of this there are two sorts, regular, and irregular: a regular figure is that where the sides and angles are equal; an irregular one is the contrary.

FILE, in the *art of war*, is an unlimited term, comprehending any number of men, drawn up in a direct line behind each other; as a rank, on the other hand, includes any number drawn beside each other; whether, in either respect, they be in close or open order. Or rather, by *file* is meant the line of soldiers standing one behind another, which makes the depth of the battalion; and is thus distinguished from the rank, which is a line of soldiers drawn up side by side, forming the length of the battalion. A file is 3 deep; hence a battalion or regiment drawn up, consists of 3 ranks, and of as many files as there are men in a rank.

File-*leader*, is the soldier placed in the front of any file, or the man who is to cover all those that stand directly in the rear of him, and by whom they are to be guided in all their movements. The files of a battalion of foot were formerly 12 and 6 deep; but now only 3, and sometimes 2 deep. Those of the cavalry are generally but 2 deep.

To double the Files, is to put 2 files into 1, making the depth of the battalion double to what it was, not in the space of ground, but in number of men.

To File *off*, } to wheel off from marching in *To defile*, } a spacious front and march in length by files. When a regiment is marching in full front, or by divisions or platoons, and comes to a defile or narrow pass, it may file off to the right or left as the ground requires, &c.

FIRE, in the *art of war*, a word of command to soldiers of all denominations, to discharge their fire-arms, grenades, cannon, &c.

Fire-*arms*, are all kinds of arms charged with powder and ball; every one of which is mentioned in their respective articles.

Running-Fire, is when a rank or ranks of men, drawn up, fire one after another; or when the lines of an army are drawn out to fire on account of a victory; when each squadron or battalion takes it from that on its right, from the right of the first line to the left, and from the left to the right of the second line, &c.

Fire-*balls*. See Balls.

Fire-*master*, in our royal regiment of artillery, is an officer of rank and dignity, who, besides the post he enjoys in the regiment, has 150l. for his office He gives the directions and proportions of all ingredients for each composition required in fire-works, whether for the service of war, or for rejoicings and recreations.

Fire-*master's mate*, is always an officer in the royal regiment of artillery, who, besides the post he bears in the regiment, has 80l. a year for this office. His duty is, to aid and assist the chief fire-master, and he should be skilled in every kind of laboratory work.

Fire-*pots*, in the *military art*, small earthen pots, into which is put a charged grenade, and over that, powder enough to cover the grenade; the whole covered with a piece of parchment, and two pieces of quick-match across lighted: it breaks and fires the powder, as also the powder in the grenade, which has no fuze, that its operations may be quicker: it burns all that is near it.

Fire-*works*, are particular compositions of different sorts, made with sulphur, salt-petre, and charcoal. They are used in war, and on rejoicing-days.

Fire-*workers*, were formerly subordinate to the fire-master and his mate; had afterwards the rank of youngest lieutenants to the royal regiment of artillery; but now that rank is abolished, and they are all second lieutenants. They were supposed to be well skilled in every kind of laboratory-work, which knowledge is an essential qualification in every officer of that regiment.

Fire-*locks*, so called from their producing fire of themselves, by the action of the flint and steel; the arms carried by a foot-soldier: they are 3 feet 8 inches in the barrel, and with the stock 4 feet 8 inches; and carry a leaden bullet of which 29 make 2 lb. its diameter is .550 of an inch, and that of the barrel 1-50th part of the shot. Fire-locks were first made use of in 1690, when match-locks were universally disused; but when invented, we cannot ascertain. A firelock is called, by writers of about the middle of the last century, *asnaphaan*, which being a Low-dutch word, seems to indicate its being a Dutch invention.

FIRINGS,

FIRINGS, in the *military art*, are of various sorts and denominations. At present we have no less than 8 or 9 different methods of firing in battalion; and as they cannot be all good, some one of them must be the best, both in regard to offensive and defensive firings; and if so, the others must in course be inferior to this. The object of firing is to do the most execution to the enemy: hence there must be some method of firing in battalion, and against battalion, more effectual than, and if so, preferable to the others. Let us attempt in some measure to determine which of these methods is the best. The present method of firing by platoons, cannot, we imagine, be the most effectual fire possible; because there are so many platoons to fire after each other, that the men must always load much faster than they are called on to fire: so that we have continually observed one of these platoons, after firing, to load again, and then remain so while one might with moderate quickness count from 180 to 260, i.e. about 3½ minutes before it becomes its turn to fire again. This is totally inconsistent with, and contradictory to, every one's ideas of a proper fire. The reason generally given for firing by platoons, is that a constant and perpetual fire shall always be kept up. How ever true this reason may be, we apprehend it will neither require nor defend the present method of platoon-firing; since a more numerous and effectual fire may be made, and also kept up so as to be perpetual. In the Prussian army, the men are taught to load with the utmost quickness; and we are well assured that they are more expeditious, both in loading and firing, than most other armies are; which perhaps one may be the more ready to conceive, from observing with how much greater expedition some of our own regiments perform than others.

Platoon-Firing, consists in three different methods, viz. standing, advancing, and retreating. Preparative to every kind of firing, each regiment or battalion must be told off in grand-divisions, sub-divisions, and platoons; exclusive of the grenadiers, which form 2 subdivisions or 4 platoons of themselves. In firing standing, whether by divisions or platoons, the first fire is from the division or platoon on the right; the second fire, from the left; the third fire, from the right again; and so on alternatively until the firing comes to the centre platoon, which is generally called the colour platoon, and does not fire, remaining as a reserve for the colours.

The platoon-firing is such as must necessarily produce a general confusion, as well by the noise of those who command, as by the breaking of the line, and kneeling, which are three of the greatest inconveniences that can happen; and it cannot be executed without imminent danger, when near the enemy. Even the king of Prussia himself is of the same opinion; for he says, "the platoon fire would, no "doubt, be the best, if it could be executed."

Firing *advancing*, is performed in the same manner as when standing, with this addition, that before either division or platoon fires, it advances 3 paces forwards; and so of the rest.

Firing *retreating*, varies greatly from either of the former methods; for before either a division or platoon fires (supposing they are marching from the enemy) it must go to the right about, and after firing, to the left about again, and continue the retreat as slow and orderly as possible.

Hedge-Firing, is only applicable when troops happen to be drawn up opposite to one another, and behind parallel fences, such as low walls, banks, hedges, &c. by the intervention of which they cannot approach nearer to each other. In this kind of firing, the men are to be drawn up 2 deep, which will of course either make their ranks more extensive, or will procure them a reserve; and in that order both ranks are to fire standing.

Parapet-Firing, like hedge-firing, cannot be introduced conveniently at the time of common exercise. This arrangement is one of those operations which are only intended for defence; and the method requisite for that disposition depends as well upon the nature of the parapet over which the men are to fire, as upon that of the attack made to possess it. Hence, this method of firing is sometimes performed by single ranks stepping upon the banquette, and firing; each man instantly handing his arms to the centre rank of the same file, and taking his back in the room of it; and then he of the centre rank gives it to him in the rear to load, and takes back his in return, ready to give to him in the front rank; by which means the front-rank man can fire 6 or 7 rounds in a minute with exactness. Parapet-firing may also be executed 2 deep, in a fortification, where the banquette is 3 feet broad, or in field-works where no banquettes are made. In short, were those who are to defend, but to understand their own advantage, and to act with temper on every occasion, they would find themselves able to baffle almost any attack that should be made against them.

Oblique-Firing, is either to the right and left, or from the right and left to the centre, depending entirely on the situation of the object to be fired against. The Prussians have a particular

ticular contrivance for this purpose: if they are to level to the right, the rear ranks of every platoon are to make two quick but small paces to the left, and the body of each soldier to turn 1-8th of a circle; and they are to take the same distance to the right, if they are to level to the left. Perhaps if one was to wheel out the divisions or platoons of a battalion 1-6th or 1-8th of a circle, it would render their fire direct, though the object be extremely oblique.

Street-Firing, is made use of when two bodies of men meet in a street, road, defile, or any such like situation, where both are equally alike inclosed in such pass, and neither of them can attack the other's flank. In our present discipline we practise two methods of street-firing; the one is, by making the division or platoon that has fired, to wheel afterwards by half-rank to the right and left outwards from the centre, and to march in that order by half-divisions down the flanks on each side of the column, and to draw up in the rear, and go on with their priming and loading. The other method is, to make the division or platoon, after firing, to face to the right and left outwards from the centre, and one half-rank to follow the other; and in that order to march in one centre file down on each side of the column into the rear, and there draw up as before.

Now, by the first method, you must have a front double the extent of your rank, otherwise, the division that fires cannot wheel out, and march into the rear: consequently the enemy will have an advantage of a front double in extent to yours; which will enable him not only to return your attack with a front of equal force, but to attack you at the same time on each flank with a quarter force more, besides the further advantage he gets by the time you spend in wheeling to clear your front for the succeeding division to come up and fire.

And as to the other method, though you increase by the extent of your ranks, and consequently the weight of your fire; yet, what is thus gained in front, is more than lost in time, by the still more tedious form of making the ranks to face to the right and left outwards, and to follow each other into the rear, which gives an opportunity that a sagacious spirited enemy will not fail to improve, and take advantage of to your total destruction.

Instead of the above methods, we should prefer the column formed of ranks; because, at most, roads, streets, &c. are seldom of equal breadth in all parts. This column can, from its construction, easily contract itself by doubling its ranks, and again unfold itself to its former breadth, as occasion requires, which operation a column of files cannot effect; and, instead of firing, only make use of the bayonet, and decide the affair by manly vigour. The advantages of this method are these: 1st, the enemy cannot get in upon either of your flanks, to disorder you; and, 2dly, as the enemy will be ignorant of your design to reserve your fire, and solely to depend upon your bayonet, he will most probably give his fire on your advancing, which as sure as he does, he is inevitably lost.

Square-Firing, is that method of firing where either a regiment or any body of men are drawn up in a hollow square, each front of which is generally divided into 4 divisions or firings, and the flanks of the square, as being the weakest part, are covered by 4 platoons of grenadiers. The first fire is from the right division of each face; the second fire from the left division of each face, and so on; the grenadiers making the last fire.

Running-Fire, when men, drawn up for that purpose, fire one after another, as fast as possible, so that it runs the whole length of the line, &c. It is used upon all public rejoicings.

Firing *by a new method proposed.* Having ventured to mention our objections to the present methods of firing, we will now take the liberty to propose an entire new scheme of firing. As the grenadier company of every battalion is frequently detached from it, at least in its firings, we will therefore say that the battalion, with which we are going to perform this new method of firing, consists of 8 companies; and as we imagine that 4 good soldiers should keep up a quick and constant fire, so we conceive that 4 good divisions should do so; and thence propose, that the battalion shall fire at 4 times. However, for reasons given, we do not mean to fire by grand divisions, but to divide each of those grand divisions into 4 platoons; and that one platoon from each grand division shall fire at the same time, or as nearly so as may be practicable. Thus 4 platoons being equal to 1 grand division, would, in effect, fire at once, but from different parts of the battalion; and the whole battalion, divided into 16 platoons, would fire at 4 times: by which method a perpetual fire will be kept up, and managed with much more ease and regularity than the present method. The Swedes were the first who practised firing by 2 or 3 ranks at a time, and that so early as 1620. Platoon-firing is the invention of the famous Gustavus Adolphus, and first used about the year 1618: we also find that Lewis XIV, in 1662, employed M. Martinet to regulate

and

and diſcipline his infantry after the Dutch manner, which was then in great eſteem under prince Maurice, of Naſſau, who had learned it from the king of Sweden.

FLAGS. See Colours, Standards, &c.

FLANKS, in the *art of war and fortifications*, are of ſeveral denominations, according to their uſes, viz.

Flanks *of an army*, are the troops encamped on the right and left of each line of encampment.

Flank *of a baſtion*, in *fortification*, that part which joins the face to the curtain, comprehended between the angle of the curtain and that of the ſhoulder, and is the principal defence of the place. Its uſe is, to defend the curtain, the flank, and face of the oppoſite baſtion, as well as the paſſage of the ditch; and to batter the ſalient angles of the counterſcarp and glacis, from whence the beſieged generally ruin the flanks with their artillery; for the flanks of a fortification are thoſe parts which the beſiegers endeavour moſt to ruin, in order to take away the defence of the face of the oppoſite baſtion.

Oblique / *Second* } Flank, { that part of the curtain from whence the face of the oppoſite baſtion may be diſcovered, and is the diſtance between the lines razant and fichant, which are rejected by moſt engineers, as being liable to be ruined at the beginning of a ſiege, eſpecially when made of ſandy earth. The ſecond parapet, which may be raiſed behind the former, is of no uſe; for it neither diſcovers nor defends the face of the oppoſite baſtion: beſides, it ſhortens the flank, which is the true defence; and the continual fire of the beſiegers cannon will never ſuffer them to raiſe a ſecond parapet. This ſecond flank defends very obliquely the oppoſite face, and is to be uſed only in a place attacked by an army without artillery.

Retired / *Low* / *Covered* } Flank, { the platform of the cazematte, which lies hid in the baſtion. Theſe retired flanks are a great defence to the oppoſite baſtion and paſſage of the ditch; becauſe the beſiegers cannot ſee, nor eaſily diſmount their guns.

Flanked *angle*, in *fortification*, that formed by the 2 faces of a baſtion, or its ſalient angle.

Flanking *angle*, in *fortification*, that compoſed of the two lines of defence, and pointing towards the curtain. See Tenaille.

Flanking *line of defence*. See *Line of defence*.

Flank *prolonged*, in *fortification*, is the extending of the flank from the angle of the epaule to the exterior ſide, when the angle of the flank is a right one.

To Flank, in the *art of war*, is to diſcover and fire upon the ſide or flank of an enemy. Any fortification, which has no defence but right forward, is faulty; and to make it complete, one part ought to flank the other.

Concave Flank, is that which is made in the arc of a circle.

Flanking, is the ſame in *fortification* as defending.

Flank, in *general*, is any part of a work that defends another work, along the outſide of its parapet.

FLASK, in *ancient military hiſtory*, a meaſure made of horn, formerly uſed to carry powder in, with the meaſure of the charge of the piece on the top of it.

FLAT-*bottomed boats*, in *military affairs*, are made to ſwim in ſhallow water, and to carry a great number of troops, artillery, ammunition, &c. They are conſtructed in the following manner: a 12-pounder, bow chaſe, an 18 ditto, ſtern chaſe; 90 to 100 feet keel; 12 to 24 ditto beam; one maſt; a large ſquare mainſail; a jibb-ſail: they are rowed by 18 or 20 oars, and can each carry 400 men. The gun takes up one bow, and a bridge the other, over which the troops are to march. Thoſe that carry horſes have the fore parts of the boats made to open, when they are to mount and ride over a bridge.

FLATTER-*mine*. See Mine.

FLECHE, in *field fortification*, a work of two faces, uſually raiſed in the field, to cover the quarter guards of a camp or advanced poſts.

FLINTS, in *military affairs*, are well known ſtones, uſed at preſent with all ſorts of fire-arms. Every ſoldier ought always to have 1 or 2 ſpare flints in war-time.

FLYING - { *army*. See Army. / *bridge*. See Bridge.

Flying-*camp*. See Camp.

FOCUS, in *mining*. See Mine.

FODDER. See Forage.

FOIL, in *fencing*, a blunt ſword, uſed to learn to fence with; it is without a point, or any ſharpneſs, having a button at the extremity, covered with leather.

FOOT, in a *military ſenſe*, ſignifies all thoſe bodies of men that ſerve on foot. See Infantry.

Foot, is alſo a long meaſure, conſiſting of 12 inches. Geometricians divide the foot into 10 digits, and the digits into 10 lines; but we divide the foot into 12 inches, and an inch into 12 lines, and a line into 12 points.

A ſquare Foot, is the ſame meaſure, both in length and breadth, containing $12 \times 12 = 144$ ſquare or ſuperficial inches.

A cubic Foot, is the ſame meaſure in all the 3 dimenſions, length, breadth, and thickneſs; containing $12 \times 12 = 144 \times 12 = 1728$ cubic inches. The foot is of different length in different countries. The Paris royal foot exceeds the Engliſh by 9 lines; the ancient Roman foot of the capital, conſiſted of 4 palms $= 11\frac{4}{10}$ Engliſh inches; and the Rhineland or Leyden foot, by which the northen nations go, is to the Roman foot as 950 to 1000. The proportions of the principal feet of ſeveral nations are as follow. The Engliſh foot being divided into 1000 parts, or into 12 inches, the other feet will be as follow:

Places.	1000 parts	feet	inch.	lines
London foot - -	1000	—	12	—
Amſterdam - -	942	—	11	3
Antwerp - - -	946	—	11	2
Bologna - - -	1204	1	2	4
Berlin - - -	1010	1	—	2
Bremen - - -	964	—	11	6
Cologne - - -	954	—	11	4
Copenhagen - -	965	—	11	6
Dantzig - - -	944	—	11	3
Dort - - -	1184	1	2	2
Frankfort on the main	948	—	11	4
The Greek - -	1007	1	—	1
Mantua - - -	1569	1	6	8
Mechlin - - -	999	—	11	—
Middlebourg - -	991	—	11	9
Paris Royal - -	1068	1	—	9
Prague - - -	1026	1	—	3
Rhineland - -	1033	1	—	4
Riga - - -	1831	1	9	9
Roman - - -	967	—	11	6
Old Roman - -	970	—	11	8
Scotch - - -	1005	1	—	$\frac{5}{7}$
Straſbourg - -	920	—	11	—
Madrid - - -	899	—	10	7
Liſbon - - -	1060	1	—	6
Turin - - -	1062	1	—	7
Venice - - -	1162	1	1	9

To be on the same foot *with another*, is to be under the ſame circumſtances in point of ſervice; to have the ſame number of men, and the ſame pay, &c.

To gain or loſe ground foot *by* foot, is to do it regularly and reſolutely; defending every thing to the utmoſt extremity, or forcing it by dint of art or labour.

Foot-*bank*, in *fortification*. See Banquette.

FORAGE, in the *art of war*, implies hay, ſtraw, and oats, for the ſubſiſtence of the army horſes. This forage is divided into rations, one of which is a day's allowance for a horſe, and contains 20lb. of hay, 10lb. of oats, and 5lb. of ſtraw.

FOREIGN *ſervice*, in *military matters*, means every ſervice but our own.

FORELAND, in *fortification*. See Berm.

FORGE, in the *train of artillery*, is generally called a *travelling-forge*, and may not be improperly called a portable ſmith's ſhop: at this forge all manner of ſmith's work is made, and it can be uſed upon a march, as well as in camp. Formerly they were very ill contrived, with 2 wheels only, and wooden ſupporters to prop the forge for working when in the park. Of late years they are made with 4 wheels, which anſwers their purpoſe much better.

Dimenſions of a travelling-Forge.

		Inches.
Fore wheels, height		104
Nave, length		14
Diameters - -	body	12
	middle	13
	linch	9
Fellies - - -	height	4
	breadth	3
Spokes - - -	breadth	1.7
	thickneſs	3
Hind wheels, height		64
Nave, length		14
Diameters - -	body	12
	middle	13
	linch	9
Fellies - - -	height	4
	breadth	3
Spokes - - -	breadth	1.7
	thickneſs	3
Fore axle-tree, total length		76
Hind axle-tree, total length		76
Body - - -	length	42
	breadth	6
	height	7
Arms, length		17
Diameters - -	body	5
	linch	3
Shafts with ſides, total length		20.5
Breadth - -	behind	4
	middle	4.5
	before	2.8
Height - - -	behind	3
	before	2
	middle	2.8
Opening - -	before	25
	middle	35
	behind	30
Naves - - -	length	14
	breadth	3
	height	6

Uprights

Uprights - -	length	27
	breadth	3
	thickneſs	2.2
Fore croſs-bar -	breadth	3
	thickneſs	2.2
Hind croſs-bar	breadth	2
	thickneſs	2.2
From the fore end to the axle-tree		23
From the hind end to the axle-tree		14
Diſtance between		74

FORGE *for red-hot balls,* is a place where the balls are made red-hot before they are fired off: it is built about 5 or 6 feet below the ſurface of the ground, of ſtrong brick-work, and an iron grate, upon which the balls are laid, with a very large fire under them. See RED-HOT BALLS.

FORLORN-*hope,* in the *military art,* ſignifies men detached from ſeveral regiments, or otherwiſe appointed to make the firſt attack in the day of battle; or at a ſiege, to ſtorm the counterſcarp, mount the breach, &c. They are ſo called from the great danger they are unavoidably expoſed to; but the expreſſion is old, and begins to be obſolete.

FORMS, FORMERS, in *gunnery,* are round pieces of wood, fitted to the bore of every gun's diameter, on which the paper, parchment or flannel, which is to make the cartridges, are rolled before they are paſted or ſewed.

FORMING *the line,* in the *military art,* drawing up infantry, cavalry, and artillery, into a line of battle, &c.

FORRAGE. See FORAGE.

FORT, in the *military art,* a ſmall fortified place, environed on all ſides with a ditch, rampart, and parapet. Its uſe is to ſecure ſome high ground, or the paſſage of a river, or to make good an advantageous poſt, to defend the lines and quarters of a ſiege, &c.

Forts are made of different figures and extents, according as the ground requires, or the ſervice intended. Some are fortified with baſtions, others with demi-baſtions. Some are in form of a ſquare, others of a pentagon. Some again are made in the form of a ſtar, having 5 or 7 angles. A fort differs from a citadel, as this laſt is built to command ſome town. See CITADEL.

Royal-FORT, one whoſe line of defence is at leaſt 26 toiſes long.

To fortify a ſquare FORT, according to the uſual method. Having inſcribed the ſquare in a circle (Plate X. fig. 1.) 1. Divide each of its ſides AB, BD, &c. into two equal parts, in the point F. 2. From the centre E, draw an indefinite line EF. 3. From the centre draw alſo the lines EA, EB, ED, EC, to the angles of the ſquare. 4. Divide the ſide AB into eight equal parts. 5. Let one of theſe parts be ſet off from F to G, and from G draw the lines of defence AG, BG. 6. Divide another ſide of the ſquare into 7 equal parts. 7. Set off two of theſe parts from A to K, and from B to L, which will be the faces of the baſtions. 8. Take the diſtance KL in your compaſſes, and ſet it off on the lines of defence from K to H, and from L to I; and draw HI, which will be the curtain; and the lines KI, LH, will be the flanks.

To fortify a ſquare fort in the moſt modern manner. Give the ſide AA (Plate X. fig. 3.) 130 fathoms; the demi-gorges AB, 25 fathoms; and with the compaſſes opened to the length of the pricked line BCB, which is the diagonal of two ſides, from each of which there has been taken 25 fathoms, upon the extremity oppoſed to the angle which they form, deſcribe two arches above the angle of the figure, alternatively making uſe of the points B for centres; then draw lines from the points of interſection of the arches D, to the point which ſerved for centres B, upon which points B, raiſe the flanks BE, perpendicular to the oppoſed lines of defence BD.

Star-FORT, a redout formed by a number of re-entering, and ſalient angles, the ſides of which flank each other. See Plate X. fig. 2.

To deſcribe a ſtar-fort. 1. Draw an hexagon $aBCdef$. 2. Divide one of its ſides BC into 4 equal parts. 3. Upon the centre of this ſide, raiſe the perpendicular DA, equal to 1-4th of the ſide BC, from D to A. 4. From the point A, draw the faces AC, AB. Let the ſame operations be performed with reſpect to the other ſides of the hexagon, and you will have the ſtar-fort required.

Triangular FORTS, are frequently made with half-baſtions; but very imperfect, becauſe the faces are not ſeen or defended from any other part. If, inſtead of being terminated at the angle, they were directed to a point about 20 toiſes from it, they would be much better, as being then defended by that length of the rampart, though but very obliquely. The ditch ought to be from 8 to 10 toiſes. See Plate X. fig. 4. Sometimes they are made as in Plate X. fig. 5. that is, triangular as before; but inſtead of half-baſtions at the angles, whole ones are placed in the middle of the ſides. The gorges of theſe baſtions may be from 20 to 24 toiſes, when the ſides are from 100 to 120; the flanks are perpendicular to the ſides, from 10 to 12 toiſes long; and the capitals from 20 to 24. If the ſides happen to be more or leſs, the parts of the

baſtions

bastions are likewise made more or less in proportion. The ditch round this fort may be 10 or 12 toises wide.

The ramparts and parapets of these sorts of works are commonly made of turf, and the outside of the parapet fraised; that is, a row of pallisades are placed about the middle of the slope, in an horizontal manner, the points declining rather a little downwards, that the grenades or fireworks thrown upon them may roll down into the ditch; and if the ditch is dry, a row of pallisades should be placed in the middle of it, to prevent the enemy from passing over it unperceived, and to secure the fort from any surprise.

FORTIFICATION, in the *military art*, is the art of fortifying a town, or other place; or of putting it in such a posture of defence, that every one of its parts defends, and is defended by some other parts, by means of ramparts, parapets, ditches, and other outworks; to the end that a small number of men within may be able to defend themselves for a considerable time against the assaults of a numerous army without; so that the enemy, in attacking them, must of necessity suffer great loss. See Plate XI. fig. 1.

Fortification may be divided into ancient and modern; offensive, and defensive; regular, and irregular; natural, and artificial, &c.

Ancient FORTIFICATION, at first, consisted of walls or defences made of trunks, and other branches of trees, mixed with earth, for security against the attacks of an enemy. Invention owes its original to necessity; *fortification* seems to have had fear for its father; for when man had no other enemy but the wild beasts, the walls of his cottage were his security; but when pride, ambition, and avarice, had possessed the minds of the strong and the daring to commit violences upon their weaker neighbours, either to subject them to new laws, or to spoil their little inheritance, it was natural for the latter to contrive how to defend themselves from such injuries.

Whoever has been in North-America, may have seen *fortification* in its infancy.

There are abundance of Indian villages fenced round by long stakes drove into the ground, with moss or earth to fill the intervals; and this is their security (together with their own vigilance) against the cruelty of their savage neighbouring nations.

Nor is *fortification* much less ancient than mankind; for Cain, the son of Adam, built a city with a wall round it upon mount Liban, and called it after the name of his son Enoch, the ruins of which, it is said, are to be seen to this day; and the Babylonians, soon after the deluge, built cities and encompassed them with strong walls.

At first people thought themselves safe enough with a single wall, behind which they made use of their darts and arrows with safety; but as other warlike instruments were continually invented to destroy these feeble structures, so on the other hand the defendants were obliged to build stronger and stronger, to resist the new contrived forces of the desperate assailers.

What improvements they made in strengthening their walls many ages ago, appear from history. The first walls we ever read of, and which were built by Cain, were of brick; and the ancient Grecians, long before Rome was ever thought of, used brick and rubble-stone, with which they built a vast wall, joining mount Hymetus to the city of Athens. The Babylonian walls, built by Semiramis, or, as others will have it, by Belus, were 32 feet thick, and 100 feet high, with towers 10 feet higher, built upon them, cemented with bitumen or asphaltus. Those of Jerusalem seem to have come but little short of them, since, in the siege by Titus, all the Roman battering-rams, joined with Roman art and courage, could remove but 4 stones out of the tower of Antonia in a whole night's assault.

When *fortification* was at this height, it stopped for many ages, 'till the use of gunpowder and guns was found out; and then the round and square towers, which were very good flanks against bows and arrows, became but indifferent ones against the violence of cannon; nor were the battlements longer a hiding-place, when the force of one shot both overset the battlement, and destroyed those who sought their security from it.

Modern FORTIFICATION, is the way of defence now used, turning the walls into ramparts, and square and round towers into bastions, defended by numerous outworks; all which are made so solid, that they cannot be beat down, but by the continual fire of several batteries of cannon. These bastions at first were but small, their gorges narrow, their flanks and faces short, and at a great distance from each other, as are those now to be seen in the city of Antwerp, built in 1540 by Charles V. emperor of Germany; since which time they have been greatly improved and enlarged, and are now arrived to that degree of strength, that it is almost a received opinion, that the art of fortification is at its height, and almost incapable of being carried to a much greater perfection. See Plate XI. fig. 1.

Offensive

Offensive FORTIFICATION, shews how to besiege and take a fortified place; it further teaches a general how to take all advantages for his troops; the manner of encamping, and method of carrying on either a regular or irregular siege, according as circumstances may direct.

Defensive FORTIFICATION, shews a governor how to make the best of a garrison committed to his care, and to provide all things necessary for its defence.

Regular FORTIFICATION, is that built in a regular polygon, the sides and angles of which are all equal, being commonly a musket-shot from each other, and fortified according to the rules of art.

Irregular FORTIFICATION, on the contrary, is that where the sides and angles are not uniform, equi-distant, or equal; which is owing to the irregularity of the ground, vallies, rivers, hills, and the like.

To FORTIFY *inwards*, is to represent the bastion within the polygon proposed to be fortified; and then that polygon is called the *exterior polygon*, and each of its sides the *exterior side*, terminating at the points of the two nearest bastions.

To FORTIFY *outwards*, is to represent the bastion without the polygon proposed to be fortified, and then the polygon is called the *interior polygon*, and each of its sides the *interior side*, terminating in the centres of the two nearest bastions.

Elementary FORTIFICATION, by some likewise called the theory of fortification, consists in tracing the plans and profiles of a fortification on paper, with scales and compasses; and examining the systems proposed by different authors, in order to discover their advantages and disadvantages. The elementary part is likewise divided into regular and irregular fortification, which see.

Practical FORTIFICATION, consists in forming a project of a fortification, according to the nature of the ground, and other necessary circumstances, to trace it on the ground, and to execute the project, together with all the military buildings, such as magazines, store-houses, barracks, bridges, &c.

The names of every part of a FORTIFICATION, and first of lines, which are divided into right lines, and curve lines.

Line of defence, is the distance between the salient angle of the bastion, and the opposite flank; that is, it is the face produced to the flank. Common experience, together with some of the greatest artists in fortification, unanimously agree, that the *lines of defence* may extend (though not exceed) 150 fathom. Some indeed will affirm that, a musket carrying no more than 130 fathom point-blank, the angle of the bastion should be no further removed from its opposite flank. I agree that a musket carries no farther point-blank; but I am sure it will do execution, and kill, at 180 fathom. The enemy generally make their breaches near the middle of the face; which if granted, the line of fire from the flank to the breach, scarce exceeds 130 fathom; besides, the cannon of the flank do less execution upon a short *line of defence* than on a long one.

Line of defence fichant, is a line drawn from the angle of the curtain, to the point of the opposite bastion, which is not to exceed 120 fathom; and from the point of the curtain, and flank, the face of the opposite bastion is to be defended. This line may not improperly be called in good English the *butting-flank*, since it partly sees the opposite faces in reverse; and the shot from it, especially near the orillon, strike against the faces. The authors are numerous both for and against the *fichant* and *razant* lines; thence we shall only add, that the more powerful the active quality is, the more the passive must suffer; that in fortification the active quality is the fire, which discovers the assailants (who are the passive) going to attack the face of the opposite bastion; and by consequence, the more this active quality is augmented, by so much more the passive subjects must suffer: and from thence we argue for the *fichant flank*, since it augments this active quality, by all the fire of the curtain added to the flank, which is the principal action in the art of defence.

Line of defence razant, is a line drawn from the point of the bastion along the face, 'till it comes to the curtain, which shews how much of the curtain will clear or defend the face. This line may very justly in our language be called the *sweeping-flank*; because the shot as it were sweeps along the opposite faces. This line, as well as the *fichant*, has many defendants, and as many opponents; thence, we will only observe, that in our humble opinions the *line fichant* is preferable to the *line razant*.

Line of circumvallation. See SIEGE. See CIRCUMVALLATION.

Line of countervallation. See SIEGE. See COUNTERVALLATION.

Line of counter-approach. See SIEGE. See APPROACHES.

Capital-line, is an imaginary line which divides the work into two equal and similar parts, or a line drawn from the point of the bastion to the point where the two demi-gorges meet, &c.

Line

Line of defence prolonged. In the ſquare, and moſt polygons of the leſſer fortification, you prolong the line of defence; but in the polygons of the greater and meaner, you draw a line from the angle of the oppoſite ſhoulder to the angle of the curtain, upon which you raiſe a perpendicular, which ſerves for the firſt line of the flank.

Names of the angles in a FORTIFICATION.

Angle of the centre, in a polygon, is formed by two radii drawn to the extremities of the ſame ſide, or from the centre, terminating at the two neareſt angles of the figure.

Angle of a baſtion, } *Flanked angle,* } that which is made by the two faces, being the utmoſt part of the baſtion, moſt expoſed to the enemy's batteries, frequently called the ſalient angle, or point of the baſtion.

Angle of the polygon, is made by the concourſe of 2 adjacent ſides of a polygon, in the centre of the baſtion.

Angle of the {
triangle, is half the angle of the polygon.
ſhoulder, } *epaule,* } is made by the face and flank of the baſtion.
flank, } *curtain,* } that which is made by, and contained between the curtain and the flank.

Angle of the tenaille, } *Flanking-angle,* } made by 2 lines fichant, that is, the faces of the 2 baſtions extended 'till they meet in an angle towards the curtain, and is that which always carries its point towards the work.

Dead-angle. } *Rentrant-angle.* } All angles are ſo called, that point inwards, or are not well defended.

Angle of the ditch, is formed before the centre of the curtain, by the outward line of the ditch.

Re-entering angle, is any angle whoſe point turns inwards, or towards the place; that is, whoſe legs open towards the field.

Salient angle, is that which points outwards, or whoſe legs open towards the place.

Angle of the complement of the line of defence, is the angle formed by the interſection of the 2 complements with each other.

Inward flanking angle, that which is made by the flanking-line, and the curtain. See ANGLE.

Names of the ſolid works of a FORTIFICATION.

Area, the ſuperficial content of a rampart, or other work.

Arrow, is a work placed at the ſalient angle of the glacis, and conſiſts of 2 parapets, each about 40 fathom long: this work has a communication with the covert-way, of about 24 or 28 feet broad, called a caponier, with a ditch before it of about 5 or 6 fathom, and a traverſe at the entrance, of 3 fathom thick, and a paſſage of 6 or 8 feet round it.

Appareille, is that ſlope or eaſy aſcent leading to the platform of the baſtion, or to any other work where the artillery, &c. are brought up and down.

Advance-foſs, } *Avant-foſſe,* } or ditch made at the foot of the glacis: it is but very ſeldom made, becauſe it is eaſily taken, and ſerves for a trench to the beſiegers.

Banquette, whether ſingle or double, is a kind of ſtep made on the rampart of a work near the parapet, for the troops to ſtand upon, in order to fire over the parapet: it is generally 3 feet high when double, and 1½ when ſingle, and about 3 feet broad, and 4½ feet lower than the parapet.

Berm, is a little ſpace, or path, of 6 or 8 feet broad, between the ditch and the talus of the parapet; it is to prevent the earth from rolling into the ditch, and ſerves likewiſe to paſs and repaſs. As it is in ſome degree advantageous to the enemy, in getting footing, moſt of the modern engineers reject it.

Baſtion, is a part of the inner incloſure of a fortification, making an angle towards the field, and conſiſts of 2 faces, 2 flanks, and an opening towards the centre of the place, called the gorge: or it is rather a large maſs of earth, uſually faced with ſods, ſometimes with brick, but rarely with ſtone.

With regard to the firſt invention of baſtions, there are many opinions amongſt authors. Some have attributed this invention to Ziſca, the Bohemian; others to Achmet Baſhaw, who having taken Otranto in the year 1480, fortified it in a particular manner, which is ſuppoſed to be the firſt inſtance of the uſe of baſtions. Thoſe who wrote on the ſubject of fortification 200 years ago, ſeem to ſuppoſe, that baſtions were a gradual improvement in the ancient method of building, rather than a new thought, that any one perſon could claim the honour of. Be as it will, they were well known ſoon after the year 1500. For in 1546, Tartalea publiſhed his *Queſiti & inventioni diverſe,* in the 6th book of which he mentions, that whilſt he reſided at Verona (which muſt have been many years before) he ſaw baſtions of a prodigious ſize; ſome finiſhed, and others building: and there is beſides, in the ſame book, a plan of Turin, which was then fortified with 4 baſtions, and ſeems to have been completed ſome time before.

The

The great rule in constructing a bastion is, that every part of it may be seen and defended from some other part: mere angles are therefore not sufficient; but flanks and faces are necessary. The faces must not be less than 50 fathom, nor more than 65. The flanks are so much the better the longer they are, and must therefore stand at right angles with the line of defence. At the same time the disposition of the flanks makes the principal part of a fortification, as on them the defence chiefly depends; and it is this that has introduced the various kinds of fortifying.

The angle of the bastion must exceed 60°; otherwise it will be too small to give room for the guns, and will either render the line of defence too long, or the flanks too short. It must therefore be either a right angle, or some intermediate one between that and 60 degrees.

Gorge of a bastion, the interval between the extremity of one flank and that of the next.

Solid bastion. } *Full bastion.* } A bastion is said to be solid or full, when the level ground within is even with the rampart; that is, when the inside is quite level, the parapet being only more elevated than the rest. They have this advantage over others, that they afford earth enough to make a retrenchment, in case the enemy lodge themselves on the top of the bastion, and the besieged are resolved to dispute every inch of ground.

Hollow bastion, } *Empty bastion,* } is that where the level ground within is much lower than the rampart, or that part next to the parapet, where the troops are placed to defend the bastion. The disadvantage of these kinds of bastions is, the earth being so low, that when an enemy is once lodged on the rampart, there is no making a retrenchment towards the centre, but what will be under the fire of the besiegers.

Detached bastion, is that which is separated or cut off from the body of the place, and differs from a half-moon, whose rampart and parapet are lower, and not so thick as those of the place, having the same proportion with the works of the place. Counter-guards with flanks are sometimes called detached bastions.

Cut bastion, is that whose salient angle or point is cut off, instead of which it has a re-entering angle, or an angle inwards, with 2 points outwards; and is used either when the angle would, without such a contrivance, be too acute, or when water, or some other impediment, prevents the bastion from being carried to its full extent.

Composed bastion, is when 2 sides of the interior polygon are very unequal, which also renders the gorges unequal: it may not improperly be called a *forced bastion*, being as it were forced into that form.

Deformed bastion, is when the irregularity of the lines and angles causes the bastion to appear deformed, or out of shape.

Demi-bastion, is composed of one face only, has but one flank, and a demi-gorge.

Double bastion, is that which is raised on the plane of another bastion, but much higher; leaving 12 or 18 feet between the parapet of the lower, and the foot of the higher; and is sometimes in the nature of a cavalier.

Regular bastion, is that which has its true proportion of faces, flanks, and gorges.

Irregular bastion, is that wherein the above equality of just proportion is omitted.

Barriers, in *fortification*, a kind of rails to stop the horse or foot from rushing in upon the besieged with violence.

Bonnet, in *fortification*, is a sort of work placed before the salient angle of the ravelin to cover it: it consists of 2 faces, parallel to the ravelin, or perpendicular to those of the lunette. They are generally made 10 fathom broad at the ends, with a ditch of the same breadth, the covert-way 6, and the glacis 20 fathom.

Breach, in *fortification*, is an opening or gap made in a wall or rampart, with either cannon or mines, sufficiently wide for a body of troops to enter the works, and drive the besieged out of it.

Practical breach, is that where men may mount, and make a lodgement, and should be 15 or 20 feet wide.

Caponier, is a passage made from one work to another, of about 10 or 12 feet wide, covered on each side by a parapet, terminating in a slope or glacis.

Cascanes, in *fortification*, a kind of cellars made under the capital of a fortification; also subterraneous passages or galleries to discover the enemy's mines.

Casemate, in *fortification*, is a work made under the rampart, like a cellar or cave, with loop-holes to place guns in it.

Cavalier, in *fortification*, is a work raised generally within the body of the place, 10 or 12 feet higher than the rest of the works. Their most common situation is within the bastion, and they are made much in the same form: they are sometimes placed in their gorges, or on the middle of the curtain, and then are in the form of a horse-shoe, only flatter.

The use of cavaliers is, to command all the adjacent works and country round them: they are

feldom or never made but when there is a hill or rising ground which overlooks fome of the works.

Coffers. See COFFERS.

Covert-way, in *fortification*, is a fpace of 6 fathom broad, going quite round the works, and is adjoined to the counterfcarp of the ditches, covered by a parapet 7½ feet high, including a banquette of 2½ feet, terminating in an eafy flope towards the field, at a diftance of 18 or 20 fathom.

Sometimes the covert-way is funk 2 or 3 feet below the horizon of the field; for, as fuch works are never made to difcover the enemy in their trenches, fo this method of lowering the covert-way will give room for the fire of the lower curtain (in works that have one) to fcour the efplanade; and the expence of it fhould be the moft material objection againft it.

Counterguard, in *fortification*, is a work placed before the baftions to cover the oppofite flanks from being feen from the covert-way; they are likewife made before the ravelins.

When counterguards are placed before the baftions, they are efteemed of very great ufe. They were firft invented by Pafino, in 1579, and greatly improved by Speckle, in 1589.

Counterfcarp, in *fortification*, is properly the exterior talus of the ditch, or the further fide from the body of the place, and facing it.

Crown-work, in *fortification*, is a kind of work not unlike a crown: it has 2 fronts and 2 branches. The fronts are compofed of 2 half-baftions and 1 whole one: they are made before the curtain or the baftion, and generally ferve to inclofe fome buildings which cannot be brought within the body of the place, or to cover the town-gates, or elfe to occupy a fpot of ground which might be advantageous to an enemy. They are of fuch an expence, that they are rarely found in practice. The beft ufe this work can poffibly be put to, is to cover 2 joining curtains, when the fides of it will be parallel to the fides of the place, and it fhould be fortified with the fame ftrength, and in the fame manner.

The authors who have written on this work, have never thought of this ufeful part; and we often fee 2 horn-works put in practice to cover 2 curtains, where the crown-work would do it much cheaper and much better.

Cordon, in *fortification*, is a round projection made of ftone, in a femi-circular form, whofe diameter is about 8 inches, and goes quite round the wall, and within 4 feet from the upper part.

Curtain, in *fortification*, is that part of the body of the place, which joins the flank of one baftion to that of another. The ftrait curtains have always been preferred to the different defigns which have been propofed, of which fome have diminifhed the expence, and (at the fame time) the ftrength of the place: others have fomewhat augmented the ftrength, but greatly diminifhed its area.

Counter-forts, in *fortification*, are by fome called *buttreffes*: they are folids of mafonry, built behind walls, and joined to them at 18 feet diftance from centre to centre, in order to ftrengthen them, efpecially when they fuftain a rampart or terras.

Cuvette, } in *fortification*, is a fmall ditch of *Cunette*, } 10 or 12 feet broad, made in the middle of a large dry ditch, ferving as a retrenchment to defend the fame, or otherwife to let water into it, when it can be had in the time of a fiege.

Demi-lune. See RAVELIN.

Detached baftion. See BASTION.

Detached redout. See REDOUT.

Ditch, in *fortification*, is a large deep trench made round each work, generally from 12 to 22 fathom broad, and from 15 to 16 feet deep: the earth dug out of it ferves to raife the rampart and parapet. Almoft every engineer has a particular depth and breadth for ditches; fome are for narrow ones and deep, others for broad ones and fhallow; and it is moft certain that ditches fhould be regulated according to the fituation. In regard to wet or dry ditches, almoft all authors have given it in favour of the latter; and we fhall only add, that the beft of all are thofe which can either be filled or kept dry at pleafure.

Embrafures. See BATTERY.

Epaulement. See SIEGE.

Exterior fide of a fortification, is the diftance or imaginary line drawn from one point of the baftion to that of the next.

Faces of the baftion. See BASTION.

Faces, of any work, in *fortification*, are thofe parts where the rampart is made, making an angle pointing outwards.

Fafcine. See BATTERY. See SIEGE.

Fauffe-bray, in *fortification*, is a low rampart going quite round the body of the place; its height is about 3 feet above the level ground, and its parapet is about 3 or 4 fathom diftant from that of the body of the place. Thefe works are made at a very great expence: their faces are very eafily enfiladed, and by confequence their flank feen in reverfe: the enemy is under cover the minute he becomes mafter of them; and a great quantity of fhells which may be thrown into them, and muft of neceffity lodge there, will

will go near to make a breach in them, or at worst to drive every one out. Hence they are liable to do more harm than good, and contribute no way to the defence of the place. Mr. Vauban, only makes them before the curtains, and as such calls them tenailles.

Flanks, in *fortification*, in general, are any parts of a work, which defend another work along the outsides of its parapets.

Flanks of the bastion, are the part between the face and curtain: the flank of one bastion serves to defend the ditch before the curtain and face of the opposite bastion.

Flanking is the same thing, in *fortification*, as defending.

Retired flanks, are those made behind the line which joins the extremity of the face and the curtain, towards the capital of the bastion.

Concave flanks, are those which are made in the arc of a circle.

Direct or grazing flank, is that which is perpendicular to the opposite face produced, and oblique or fichant, when it makes an acute angle with that face.

Second flank. When the face of a bastion produced does not meet the curtain at its extremity, but in some other point; then the part of the curtain between that point and the flank, is called the second flank. The modern engineers have rejected this method of fortifying. See Flank.

Fleche, a work of 2 faces, often constructed before the glacis of a fortified place, when threatened with a siege, in order to keep the enemy as long at a distance as possible.

Genouilliers, the undermost part of a battery, or the part from the platform to the embrasures.

Glacis, in *fortification*, is the part beyond the covert-way, to which it serves as a parapet, and terminates towards the field in an easy slope at about 20 fathom distance. Sometimes double glacis are made parallel to the esplanade, and at the distance of 16 or 20 fathoms. Some authors think these works never answer the expence; however, M. Vauban was so sensible of their goodness, that he never failed to make them when he found the ground convenient for it; because, when such works are defended by a skilful governor, they will make a noble defence.

Gorge, of a bastion, is the interval between the extremity of one flank and that of the other.

Gorge, of any work, is that part next to the body of the place, where there is no rampart or parapet; that is, at the counterscarp of the ditch.

Hornwork, in *fortification*, is composed of a front and 2 branches: the front is made into 2 half-bastions and a curtain: this work is of the nature of a crown-work, only smaller, and serves for the same purposes. The use of horn-works in general is to take possession of some rising ground advanced from the fortification; the distance of which determines that of the horn-work; and they are placed either before the curtain, or before the bastions, according to circumstances.

Horse-shoe, is a small round or oval work, with a parapet, generally made in a ditch, or in a marsh.

Half-moon. See Ravelin.

Lodgements. See Siege.

Loop-holes, in *fortification*, are either square or oblong holes, made in the wall, to fire through with muskets.

Lunettes, in *fortification*, are works made on both sides of a ravelin: one of their faces is perpendicular to half or 2-3ds of the faces of the ravelin, and the other nearly so to those of the bastions.

There are likewise lunettes, whose faces are drawn perpendicular to those of the ravelin, within 1-3d part from the salient angle; whose semi-gorges are only 20 fathoms.

These kinds of works make a good defence, and are of no great expence; for as they are so near the ravelin, the communication with it is very easy, and one cannot well be maintained 'till they are all three taken.

Lunettes, are also works made beyond the second ditch, opposite to the places of arms: they differ from the ravelins only in their situation.

Lunettons, are small lunettes.

Merlon, in *fortification*, that part of the breast-work of a battery, which is between the embrasures.

Orillon, in *fortification*, is a part of the bastion near the shoulder, which serves to cover the retired flank from being seen obliquely: it is sometimes faced with stone, on the shoulder of a cazematted bastion, to cover the cannon of the retired flank, and hinder them from being dismounted by the enemy's cannon.

Of all the works in a fortification, there is none more capable to defend the passage of the ditch, and to destroy the miner, wheresoever he enters himself, than the orillon. Experience in the last war has shewn us of what vast advantage it is to have 2 or 3 reserve pieces of cannon, which command the ditch, and the face of the opposite bastion, in such a manner as to destroy the attempts of the miners, and see the breach in reverse. Hence the great advantages of a double flank thus concealed, weigh so very much with

with us, and convince us so entirely of their usefulness, that we affirm no place to be well fortified without the orillon, and that the strait flank is fit for nothing but field-works.

The orillon is as old as the bastion, and was first made use of about the year 1480; and we find them frequent in the works of Pasino and Speckle, first published in 1579 and 1589.

Out-works. See Works.

Pallisades, in *fortification,* are a kind of stakes made of strong split wood of about 9 feet long, fixed 3 feet deep in the ground, in rows about 6 inches asunder: they are placed in the covert-way, at 3 feet from, and parallel to the parapet of the glacis, to secure it from being surprised.

Parapet, in *fortification,* is a part of the rampart of a work, of 18 or 20 feet broad, and raised 6 or 7 feet above the rest of the rampart: it serves to cover the troops placed there to defend the work against the fire of the enemy.

Parallels. See Siege.

Port-cullice, in *fortification,* is a falling gate or door, like a harrow, hung over the gates of fortified places, and let down to keep out the enemy.

Place of arms, in *fortification,* is a part of the covert-way, opposite to the re-entering angle of the counterscarp, projecting outward in an angle. They are generally 20 fathoms from the re-entering angle of the ditch on both sides, and the faces are found by describing a radius of 25 fathoms.

Places of arms. See Siege.

Pits or *ponds,* in *fortification,* are little holes dug between the higher and lower curtains, to hold water, in order to prevent the passing from the tenailles to the flanks.

Profiles, in *fortification,* are representations of the vertical sections of a work; and serve to shew those dimensions which cannot be represented in plans, and are yet necessary in the building of a fortification: they may be very well executed and constructed upon a scale of 30 feet to an inch. By a profile are expressed the several heights, widths, and thicknesses, such as they would appear were the works cut down perpendicularly from the top to the bottom.

Rampart, in *fortification,* is an elevation of earth raised along the faces of any work, of 10 or 15 feet high, to cover the inner part of that work against the fire of an enemy: their breadths differ according to the several systems; for De Ville makes them 12½ fathoms, M. Vauban 6, and others 10 fathoms.

Rams-horns, in *fortification,* are a kind of low work made in the ditch, of a circular arc: they were first invented by Mr. Belidor, and serve instead of tenailles.

Ravelin, in *fortification,* is a work placed before the curtain to cover it, and prevent the flanks from being discovered sideways: it consists of 2 faces meeting in an outward angle. Some ravelins are counterguarded, which renders them as serviceable as either the cunettes or tenaillons.

Redans, in *fortification,* are a sort of indented works, consisting of lines or faces that form sallying or re-entering angles, flanking one another, and are generally used on the sides of a river running through a garrisoned town. They were used before bastions. Sometimes the parapet of the covert-way is carried on in this manner.

Redout, in *fortification,* is a kind of work placed beyond the glacis, and is of various forms. Their parapets, not being to resist cannon, are only 8 or 9 feet thick, with 2 or 3 banquettes. The length of their sides may be from 10 to 20 fathoms.

Redout, is also the name of a small work, made sometimes in a bastion, and sometimes in a ravelin, of the same form.

Redout, is likewise a square work without any bastions, placed at some distance from a fortification, to guard a pass, or to prevent an enemy from approaching that way.

Detached redout, is a kind of work much like a ravelin, with flanks placed beyond the glacis: they are made to occupy some spot of ground which might be advantageous to the besiegers; likewise to oblige the enemy to open their trenches farther off than they would do otherwise. Their distance from the covert-way should not exceed 120 toises, that it may be defended by musket-shot from thence.

Redouts-en-cremaillere, so called from their figure resembling a pot-hook, the inside line of the parapet being broken in such a manner, as to resemble the teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defilé, than if only a simple face was opposed to it, and consequently the passage is rendered more difficult.

Revetement, in *fortification,* is a strong wall built on the outside of the rampart and parapet, to support the earth, and prevent its rolling into the ditch. When the revetement of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a square stone at the top of it, projecting about 5 or 6 inches, and a circular one below, or where the slope begins, of 8 or 10 inches diameter. They go quite round the rampart, and the circular projection is called the *cordon.*

Retrenchment, in *fortification,* is any work raised to cover a post, and fortify it against an enemy,

enemy, ſuch as faſcines loaded with earth, gabions, ſand-bags, &c.

Retrenchment. See SIEGE.

Rideau, in *fortification*, is a ſmall elevation of earth, extending lengthways on a plane, and ſerving to cover a camp, or to give an advantage to a poſt. They are alſo convenient for the beſiegers of a place, as they ſerve to ſecure the workmen in their approaches to the foot of a fortreſs.

Rideau, is alſo uſed ſometimes for a trench, the earth of which is thrown up on its ſides, to ſerve as a parapet for covering the men.

Sap. See SIEGE.

Sillon, in *fortification*, a work raiſed in the middle of a ditch to defend it when too broad. This work has no particular form, but as it runs, forms little baſtions, half-moons, and redans, which are lower than the rampart of the place, but higher than the covert-way. It is not much uſed at preſent.

Talus, in *fortific tion*, are ſlopes made both on the outſide and inſide of every work, to prevent the earth's rolling down; and are of various denominations, viz.

Talus of the vanquette, is that gentle ſlope from the top of the banquette to the horizontal line.

Interior talus of the parapet, the ſlope from the top of the parapet to the banquette.

Talus of the top of the parapet, that ſlope which leſſens the height of the parapet towards the berm, by which means the troops firing from the banquette can defend the covert-way.

Exterior talus of the parapet, the ſlope of the parapet from the top to the berme.

Interior talus of the ditch, the ſlope from the top of the ditch to the bottom, within.

Exterior talus of the ditch, is the ſlope from the top of the ditch to the bottom, without.

Traverſe, in *fortification*, is a parapet made croſs the covert-way, oppoſite to the ſalient angles of the works, and near the places of arms, to prevent enfilades; they are 18 or 20 feet thick, and as high as the ridge of the glacis. There are alſo traverſes made in the caponiers, but then they are called *tambours*.

Traverſes, are likewiſe made within other works, when there are any hills or riſing grounds which may ſee the inſides of theſe works. Traverſes that are made to cover the entrances of redouts in the field, need not be above 8 or 10 feet thick.

Tenailles, in *fortification*, are low works made in the ditch before the curtains; of which there are 3 ſorts. The firſt are the faces of the baſtions produced 'till they meet, but much lower; the ſecond have faces, flanks, and a curtain; and the third have only faces and flanks. Their height is about 2 or 3 feet higher than the level ground of the ravelin. Their uſe is to defend the bottom of the ditch by a grazing fire, as likewiſe the level ground of the ravelin, and eſpecially the ditch before the redout within the ravelin, which can be defended from no where elſe ſo well as from them.

Tenaillons, in *fortification*, are works made on each ſide of the ravelin, much like the lunettes; and only differ, in that one of the faces in a tenaillon is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

Tower-baſtions, in *fortification*, are ſmall towers made in the form of baſtions; firſt invented by Mr. Vauban, and uſed in his ſecond and third method; with rooms or cellars underneath, to place men and artillery in them. As theſe towers are almoſt a ſolid piece of maſonry, they muſt be of great expence, though their reſiſtance can be but little; for it has been found by experience, that the caſemates are but of little uſe, becauſe as ſoon as they have fired once or twice, the ſmoke will oblige the defenders to leave them, notwithſtanding the ſmoke-holes: hence it may be concluded that the ſtrength of theſe tower-baſtions does by no means anſwer their expences; and that, if ſmall baſtions were made inſtead of them, without caſemates, they would be much better, and of leſs expence.

Terre-pleine, in *fortification*, the horizontal ſuperficies of the rampart, between the interior talus and the banquette.

Traditore, in *fortification*, ſignifies the concealed or hidden guns in a fortification, behind the reverſe of the orillon.

Trous-de-loup, in *fortification*, round holes made about 5 or 6 feet deep, with a ſtake in the middle: they are generally dug round a field redout, to obſtruct the enemy's approach; circular at top, and about 4½ feet diameter; pointed at the bottom like an inverted cone. Two or three rows of them are dug chequerwiſe, about 6 paces from the edge of the ditch, viz. two rows of holes exactly oppoſite to each other, and a third row in the middle, covering the intervals.

Zic-Zac. See SIEGE.

The principal maxims of fortification, are theſe, viz. 1. That every part of the works be ſeen and defended by other parts, ſo that the enemy can lodge no where without being expoſed to the fire of the place.

2. A fortrefs fhould command all places round it; and therefore all the outworks fhould be lower than the body of the place.

3. The works fartheft from the centre fhould always be open to thofe that are nearer.

4. The defence of every part fhould always be within the reach of mufket-fhot, that is, from 120 to 150 fathoms, fo as to be defended both by great and fmall fire-arms; for if it be only defended by cannon, the enemy may difmount them by the fuperiority of their's, and then the defence will be deftroyed at once; whereas, if a work is likewife defended by fmall-arms, if the one is deftroyed, the other will ftill fubfift.

5. All the defences fhould be as nearly direct as poffible; for it has been found by experience, that the foldiers are too apt to fire directly before them, without troubling themfelves whether they do execution or not.

6. A fortification fhould be equally ftrong on all fides; otherwife the enemy will attack it in the weakeft part, whereby its ftrength will become ufelefs.

7. The more acute the angle at the centre is, the ftronger will be the place.

8. In great places, dry ditches are preferable to thofe filled with water, becaufe fallies, retreats, fuccours, &c. are neceffary; but, in fmall fortreffes, wet ditches, that can be drained, are the beft, as ftanding in need of no fallies.

Field-Fortification, is the art of fortifying, conftructing, attacking, and defending, all forts of temporary field-works during a campaign.

Different authors recommend different methods of fortification; but the principal are thofe of Pagan, Blondel, Vauban, Coehorn, Belidor, Scheiter, and Muller.

Fortification, according to the method of Pagan, confifts in three different forts, viz. the great, the mean, and little, whofe principal dimenfions are contained in the following

Table.

	The great Fortification.		The mean.		The little.	
	for fquares	for all other polygons	for fquares	for all other polygons	for fquares	for all other polygons
Exterior fide -	200	200	180	180	160	160
The perpendicular	27	30	24	30	[illegible]1	30
The face - -	60	60	55	5[illegible]	45	50
The flank - -	22	24 2	19 1	[illegible]4	18 3	23 2
The curtain - -	73 2	70 5	63 4	60 4	63 5	50 4
The line of defence	141 4	141 2	126 1	1[illegible]6 5	[illegible]15 5	112 3

Blondel fortifies within the given polygon: he eftablifhes two forts of fortification; the great one, whofe exterior fide is 200 toifes, and the leffer one 170; becaufe he will not have the line of defence exceed 140 toifes, which is the greateft mufket-fhot, nor lefs than 120 toifes, not to increafe the number of baftions. He begins by the diminifhing angle, which may be found by taking 90 degrees from the angle of the polygon, and by adding 15 degrees to the third of the remainder.

Vauban's method is divided into little, mean, and great: the little is chiefly ufed in the conftruction of citadels; the mean, in that of all forts of towns; and the great, in particular cafes only.

Table.

TABLE.

	Forts						Little				Mean		Great	
Side of polygon	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicular	10	11	12½	14	15	16	20	21	23	25	30	31	25	22
Faces bastion	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cap. of Ravel.	25	28	30	35	38	40	45	50	50	52	55	55	60	50

In the firſt vertical column are the numbers expreſſing the lengths of the exterior ſides from 80 to 260.

In the ſecond, the perpendiculars anſwering to theſe ſides.

In the third, the lengths of the faces of the baſtions; and in the fourth, the lengths of the capitals of the ravelins.

Belidor's method is divided alſo into little, mean, and great: and in all three the exterior ſide is 200 toiſes; the perpendicular of the little is 50, that of the mean 55, and the great 40: the faces of the firſt 70, the ſecond 70, and the third 55 toiſes.

Scheiter's method is divided into the great, mean, and ſmall ſort. The exterior ſide of the polygon for the great ſort is 200 toiſes, the mean ſort 180, and the ſmall 160. The line of defence in the firſt is 140 toiſes, the ſecond 130, and the third 120. This line is always razant. All the other lines are fixed at the ſame length for all polygons, whoſe ſtructure chiefly depends upon the knowledge of the exterior ſide, of the capital, or of the flanked angle, the reſt being eaſily finiſhed.——See the TABLE.

TABLE *of capitals and flanked angles.*

Polygons	IV	V	VI	VII	VIII	IX	X	XI	XII
The flanked angles in the 3 ſorts of fortification.	deg. 64	76	84	90	95	97	99	101	103
Capital for the great ſort.	toiſes 46	49	51	52	53	54½	56½	58	59
Capital for the mean ſort.	42	44½	46½	48½	50	51	52½	54	54
Capital for the ſmall ſort.	39	41½	42½	45	46	47½	48½	50	50½

FORTIN, FORTLETT. See FIELD-FORT.

FOSS, in *fortification.* See DITCH.

FOUCADE, FOUGADE, in *mining.* See FOUGASS.

FOUNDATION, in *military architecture*, is that part of a building which is under ground, or the maſs of ſtone, brick, &c. which ſupports a building, or upon which the walls of a ſuperſtructure are raiſed: or it is the coffer or bed dug below the level of the ground, to raiſe a building upon; in which ſenſe, the *foundation* either goes to the whole area or extent of the building, as when there are to be vaults, galleries, caſemates, or the like; or is drawn in cuts or trenches, as when only walls are to be raiſed. Sometimes the *foundation* is maſſive, and continued under the whole building, as in the antique arches and aqueducts; but it is more uſually in ſpaces or intervals; in which latter caſe, inſulated pillars, bound together by arches, ſhould be uſed.

There are ſeveral things to be well conſidered in laying the *foundation* of a military building. We muſt firſt examine the bed of the earth upon which we are to build, and then the under fillings or ſubſtruction. We are not to reſt upon any appearing ſolidity, unleſs the whole mould through which we cut has likewiſe been ſolid; and in ſuch caſes, allow 1-6th part of the height of the building for the hollowing or under-digging, unleſs there be cellars under ground, in which caſe it may be ſomething leſs.

There are many ways to try the firmneſs of the ground; but the following, in our opinion, is the beſt. Take an iron crow, or ſuch a borer as well-diggers uſe, which at once will point out the goodneſs and tenacity of the ground.

Engineers ſhould uſe the utmoſt diligence in this point; for, of all the errors that may happen in building, thoſe are the moſt pernicious which are committed in the foundation, becauſe they bring with them the ruin of the whole building; nor can they be amended without very great difficulty.

Foundations are either natural, or artificial: natural, as when we build on a rock, or very ſolid earth; in which caſe we need not ſeek for any other ſtrengthening; for theſe, without digging, or other artificial helps, are of themſelves excellent *foundations*, and moſt fit to uphold the greateſt buildings. But if the ground be ſandy or marſhy, or have lately been dug, in ſuch caſe recourſe muſt be had to art. In the former caſe, the engineer muſt adjuſt the depth of the *foundation* by the height, weight, &c. of the building: 1-6th part of the whole height is looked upon as a medium; and as to the thickneſs, double that of the width of a wall is a good rule. If you build upon moſſy and looſe earth, then you muſt dig 'till you find ſound ground. This ſound ground, fit to ſupport a building, is of divers kinds: in ſome places ſo hard, as ſcarcely to be cut with iron; in other places very ſtiff; in other places blackiſh, which is accounted the weakeſt; in others like chalk, and in others ſandy: but of all theſe, that is the beſt which requires moſt labour in cutting or digging, and when wet, does not diſſolve into dirt.

If the earth to be built upon is very ſoft, as in mooriſh grounds, or ſuch that the natural *foundation* cannot be truſted, then you muſt get good pieces of oak, whoſe length muſt be the breadth of the trench, or about 2 feet longer than the wall: theſe muſt be laid acroſs the *foundation*, about 2 feet aſunder, and being well rammed down, lay long planks upon them; which planks need not lie ſo broad as the pieces are long, but only about four inches on a ſide wider than the baſis or foot of the wall is to be. But if the ground be ſo very bad, that this will not do, then you muſt provide good piles of oak, of ſuch a length as will reach the good ground, and whoſe diameter muſt be about 1-12th part of their length. Theſe piles muſt be driven down by an engine for that purpoſe, and muſt be placed as cloſe as one can ſtand by another; then lay planks upon them, and pin them faſt. But if the ground be faulty in ſome parts, and firm in others, you may turn arches over thoſe looſe places, which will diſcharge them of the weight. You muſt not forget to place the piles under the inner, as well as the outer walls; for if theſe ſhould ſink, it would be a means to make the outer walls crack, and ſo ruin the whole building.

Having thus far conſidered the bed of the earth on which the building is to be erected, we ſhall next conſider the ſubſtruction, as it was called by the ancients; but our modern engineers call it the *foundation*. This is the ground-work of the whole edifice, which muſt ſuſtain the walls, and is a kind of artificial, as the other was natural; as to which, theſe things that follow are moſt neceſſary to be obſerved. 1. That the bottom be exactly level; therefore lay a platform of good boards. 2. That the loweſt ledge or row be all of ſtone, the broader the better, laid cloſely without mortar; which is a general caution for all parts of a building that are contiguous to board or timber; becauſe lime and wood are utter enemies to one another, and, if unfit confiners any where, they are more eſpecially ſo in the foundation. 3. That the breadth of the *foundation* be at leaſt double the breadth of the wall that is to be raiſed upon it: but even in this caſe art ſhould give way to diſcretion; and the foundation may be made either broader or narrower, according as the ground, and the ponderoſity of the edifice, require. 4. That the *foundation* be made to diminiſh as it riſes, but yet ſo that there may be as much left on the one ſide as on the other; ſo that the middle of that above may be perpendicularly over the middle of that below, which ſhould in like manner be obſerved in diminiſhing the walls above ground; for by this means the building will become much ſtronger than it would be if the diminution were made any other way. 5. That you ſhould never build on the ruins of an old foundation, unleſs you are well aſſured of its depth, and that its ſtrength is ſufficient to bear the building.

The ſtones in the *foundation* ſhould be laid as they naturally lay in the quarry, for they have the moſt ſtrength in their natural poſition. This ſhould be obſerved in all parts of a building, becauſe all ſtones have a cleaving grain; conſequently, if the horizontal poſition of the ſtones in the quarry ſhould be placed vertically in the building, the ſuper-incumbent

cumbent weight would be apt to cleave them, and so render the building ruinous.

FOUNDERY, FOUNDRY, in *military matters*, the art of casting all kinds of ordnance, such as cannon, mortars, howitzers, &c. It likewise signifies the place or work-house wherein these operations are performed. At present all pieces of artillery are cast solid, and bored afterwards. Formerly guns were bored perpendicularly, but at present in a horizontal position: the boring instrument is fixed immoveably, and forced into the gun or mortar by a mechanical power. The piece of artillery is turned round by a large wheel and horses; and at the same time the gun is bored, the outside is turned and polished, by another very curious machine for that purpose, invented by the very ingenious Messrs. Verbruggen, founders at Woolwich. Guns were first founded in England in 1587.

FOURNEAU, in *mining*. See CHAMBER. See MINE.

FOUGASS, in *mining*, a small mine, from 6 to 8 feet under ground: they are generally placed under the glacis or dry ditches.

FOYER, in *mining*. See MINE.

FRAISE, in *fortification*, a kind of stakes or palisades placed horizontally on the outward slope of a rampart made of earth, to prevent the work being taken by surprise. They are generally 7 or 8 feet long, and about 5 inches thick. When an army intrenches itself, they often fraise the parapets of their retrenchments in the parts most exposed to an attack.

To FRAISE *a battalion*, is to line or cover it every way with pikes, that it may withstand the shock of a body of horse.

FRICTION, in *mechanics*, the rubbing of the parts of engines and machines against each other, by which a considerable part of their effect is destroyed.

It is hardly possible to lay down general rules for computing the quantity of friction, because it depends upon a multiplicity of circumstances, as the structure, firmness, elasticity, &c. of bodies rubbing against each other. Some authors make the friction upon a horizontal plane, equal to 1-3d of the weight to be moved; while others have found it to be considerably less. But however this be, the doctrine of friction, as ascertained by the latest experiments, may be summed up in the following manner.

1. When one body rests on another upon a horizontal plane, it presses it with its whole weight, which being equally re-acted upon, and consequently the whole effect of its gravity destroyed by the plane, it will be absolutely free to move in any horizontal direction by any the least power applied thereto, provided both the touching surfaces be smooth.

2. But since we find no such thing as perfect smoothness in the surfaces of bodies, arising from their porosity and peculiar texture, it is easy to understand, that when two such surfaces come together, the prominent parts of the one will, in some measure, fall into the concave parts of the other: and therefore, when an horizontal motion is attempted in one, the fixed prominent parts of the other will give more or less resistance to the moving surface, by holding and retaining its parts; and this is what we call friction.

3. Now since any body will require a force equal to its weight, to draw it over a given obstacle, it follows that the friction arising to the moving body, will always be in proportion to its weight only, and not to the quantity of the surface, by which it bears upon the resisting plane or surface. Thus if a piece of wood 4 inches wide, and 1 thick, be laid upon another fixed piece of the same wood, it will require the same weight to draw it along, whether it be laid on its broad or narrow side.

4. For, though there be 4 times the number of touching particles on the broad side (*cæteris paribus*) yet each particle is pressed but with 1-4th of the weight that those are on the narrow side; and since 4 times the number, multiplied by 1-4th of the weight, it is plain the resistance is equal in both places, and so requires the same force to overcome it.

5. The reason why friction is proportional to the weight of the moving body, is, because the power applied to move the body must raise it over the prominent parts of the surface on which it is drawn; and this motion of the body, as it is not upright, will not require a power equal to its whole weight; but being in the nature of the motion on an inclined plane, it will only require a part of its own weight, which will vary with the various degrees of smoothness and asperity.

6. It is found by experiment, that a body will be drawn along by nearly 1-3d of its weight; and if the surfaces be hard and well polished, by less than 1-3d part; whereas, if the parts be soft or rugged, it will require a much greater weight.

The ingenious Mr. Emerson, in his principles of Mechanics, has given us the following rules deduced from experiments; but they require some variation under different circumstances, which must be left to the judgment of the artist.

 1. Wood

1. Wood and all metals, when greased, have nearly the same friction; and the smoother they are, the less friction they have; yet metals may be so far polished as to increase friction by the cohesion of their parts.

Wood slides easier upon the ground in wet weather than in dry, and easier than iron in dry weather; but iron slides easier than wood in wet weather. Lead makes a great deal of resistance. Iron or steel running in brass, makes the least friction of any. In wood acting against wood, grease makes the motion twice as easy, or rather 2-3ds easier. Wheel-naves, greased or tarred, go 4 times easier than when wet.

Metals oiled make the friction less than when polished, and twice as little as when unpolished.

In general, the softer or rougher the bodies, the greater their friction.

2. As to particular cases: a cubic piece of soft wood of 8 pounds weight, moving upon a smooth plane of soft wood, at the rate of 3 feet per second; its friction is about 1-3d of the weight of it; but if it be rough, the friction is little less than 1-half the weight.

Upon the same supposition, other soft wood upon soft wood very smooth, the friction is about 1-4th of the weight.

Soft wood upon hard, or hard wood upon soft, 1-5th or 1-half of the weight. Hard wood upon hard wood, 1-7th or 1-8th of the weight.

Polished steel moving upon steel or pewter, 1-4th of the weight; moving on copper or lead, 1-5th of the weight; on brass, 1-5th of the weight. Metals of the same sort have more friction than different sorts.

The friction, *cæteris paribus*, increases with the weight almost in the same proportion. The friction is also greater with a greater velocity, but not in proportion to it, except in very few cases. A greater surface also causes something more friction, with the same weight and velocity; yet friction may sometimes be increased by having too little surface to move on; as upon clay, &c. where the body sinks.

3. The friction arising from the bending of ropes about machines, differs according to their stiffness, the temper of the weather, degree of flexibility, &c. but, *cæteris paribus*, the force or difficulty of bending a rope is as the square of the diameter of the rope, and its tension, directly; and the diameter of the cylinder or pully it goes about, reciprocally.

A rope of 1 inch diameter, whose tension or weight drawing it is 5 pounds, going over a pully 3 inches diameter, requires a force of 1 pound to bend it.

4. The resistance of a plane moving through a fluid is as the square of the velocity; and putting $v =$ velocity in feet in a second; it is equal to the weight of a column of the fluid, whose base is the plane, and height $\frac{vv}{64}$. And in a globe it is but half so much.

5. As to the mechanic powers, the single lever makes no resistance by friction; but if, by the motion of the lever in lifting, the fulcrum, or place of support, be changed further from the weight, the power will be decreased thereby.

6. In any wheel of any machine, running upon an axis, the friction on the axis is as the weight upon it, the diameter of the axis, and the angular velocity. This sort of friction is but small.

7. In the pulley, if p, q, be 2 weights, and q the greater; and $w = \frac{4pq}{p+q}$, then w is the weight upon the axis of the single pulley; and it is not increased by the acceleration of the weight q, but remains always the same.

The friction of the pullies is very considerable, when the sheaves rub against the blocks; and by the wearing of the holes and axles.

The friction of the axis of the pulley is as the weight w, its angular velocity, the diameter of the axis directly, and the diameter of the pulley inversely. A power of 100 pounds, with the addition of 50 pounds, will but draw up 500 with a tackle of 5; and 15 pounds over a single pulley will draw up only 14 pounds.

8. In the screw, there is a great deal of friction: those with sharp threads have more friction than those with square threads; and endless screws have more than either. Screws with a square thread raise a weight with more ease than those with a sharp thread.

In the common screw the friction is so great, that it will sustain the weight in any position given, when the power is taken off; and therefore the friction is at least equal to the power. From whence it will follow, that in the screw, the power must be to the weight or resistance, at least as twice the perpendicular height of a thread, to the circumference described by one revolution of the power; if it be able to raise the weight, or only sustain it. This friction of the screw is of great use, as it serves to keep the weight in any given position.

9. In the wedge, the friction is at least equal to the power, as it retains any position it is driven into; therefore in the wedge, the power must be to the weight at least as twice the base to the height, to overcome any resistance.

10. To find the friction of any engine, begin at the power, and consider the velocity and the weight at the first rubbing part; and estimate its quantity of friction by some of the foregoing articles; then proceed to the next

rubbing

rubbing part, and do the ſame for it, and ſo on through the whole.

And note, that ſomething more is to be allowed for increaſe of friction by every new addition to the power.

FRONT, *of a regiment*, the foremoſt rank of a battalion, ſquadron, or any other body of men. To front every way, is when the men are faced to all ſides.

FRONT *of a fortification*. See FACE.

FURLOUGH, in *military matters*, a licence granted by an officer to a ſoldier, to be abſent for a time from his duty. All ſoldiers found half a league from a camp or garriſon, going towards an enemy's country, or quarters, without a paſs, are deemed and treated as deſerters.

FUNERALS. See BURIALS.

FUZE. See LABORATORY.

FUZILIERS, in *military matters*, are ſoldiers armed as the reſt of the infantry, but wearing caps like the grenadiers, though ſomewhat ſhorter. There are three regiments in the Engliſh ſervice: the royal regiment of Scotch Fuziliers, raiſed in 1678; the royal regiment of Engliſh Fuziliers, raiſed in 1685; and the royal regiment of Welſh Fuziliers, raiſed in 1688-9.

FUZEE, or FUSEE. See FIRELOCK. See MUSKET.

FYF-MAJOR. See MAJOR.

G

GABIONS, in *fortification*, are a kind of baſkets made of ozier-twigs, of a cylindrical form, having different dimenſions, according to what purpoſe they are uſed. Some are 5 or 6 feet high, and 3 feet in diameter: theſe ſerve in ſieges to carry on the approaches under cover, when they come pretty near the fortification. Thoſe uſed in field-works are 3 or 4 feet high, and 2½ or 3 feet diameter. There is alſo a kind of gabions, about 1 foot high, 12 inches diameter at top, and from 8 to 10 at bottom, which are placed along the top of the parapet, to cover the troops in firing over it.

In order to make them, ſome pickets, 3 or 4 feet long, are ſtruck into the ground, in form of a circle. and of a proper diameter, wattled together with ſmall branches, in the manner of common fences. Batteries are often made of gabions. See BATTERY.

Stuft-GABIONS, in *fortification*, are made in the ſame manner as the former: they are only filled with all ſorts of branches and ſmall wood, and are 4 or 6 feet long: they ſerve to roll before the workman in the trenches, to cover them in front againſt muſket-ſhot.

GALLERY, { in *fortification*. See SIEGE. / of a *mine*. See MINE. }

GALLOPER-*Carriage*, in *artillery*. See CARRIAGE.

GANTLET, GAUNTLET, } in *ancient military hiſtory*, a large kind of glove, made of iron, and the fingers covered with ſmall plates: it was formerly worn by cavaliers, or ſingle knights of war, when armed at all points.

GANTLOPE, denotes a kind of military puniſhment, in which the criminal running between the ranks receives a laſh from each man. See *Run the gantlope*.

GARDENS, in our *ancient military hiſtory*, were of two different kinds, viz.

Artillery-GARDEN, about the year 1650, was a famous place in London, where vaſt numbers of young people took great delight in every kind of artillery exerciſes, in ſo far that it was famous through the whole world, and univerſally ſtiled the great nurſery, or academy of military diſcipline.

Military-GARDEN, was likewiſe famous, about the year 1650, in the city of London, for the great improvement of numbers of our nobility, and other gentlemen of faſhion, in every kind of military exerciſe. The captains in chief of thoſe academies or gardens were major-general Skippon, and major Tillyer.

GARNISH-*bolt*, or *nails*. See CARRIAGE.

GARRISON, in the *art of war*, a body of forces, diſpoſed in a fortreſs or garriſon town, to defend it againſt the enemy, or to keep the inhabitants in ſubjection; or even to be ſubſiſted during the winter ſeaſon: hence garriſon and winter-quarters are ſometimes uſed indifferently, for the ſame thing; and ſometimes they denote different things. In the latter caſe, a garriſon is a place wherein forces are maintained to ſecure it, and where they keep regular guard, as a frontier town, a citadel, caſtle, tower, &c. The garriſon ſhould always be ſtronger than the townſmen.

Winter-quarters ſignifies a place where a number of forces are laid up in the winter ſeaſon, without keeping the regular guard. See WINTER-QUARTERS.

GARRISON-*town*, generally a ſtrong place in which troops are quartered, and do duty, for the ſecurity thereof, keeping ſtrong guards at each port, and a main-guard in or near the market-place.

Order of the GARTER, a military order of knighthood, the moſt noble and ancient of any lay-order in the world, inſtituted by king Edward III. This famous order conſiſts of 26 knights companions, generally princes and peers, whereof the king of England is the ſovereign or chief. They are a college or corporation, having a great and little ſeal.

Their officers are a prelate, chancellor, regiſter, king at arms, and uſher of the black rod. They have alſo a dean and 12 canons, and petty canons, vergers, and 26 penſioners, or poor knights. The prelate is the head. This office is veſted in the biſhop of Wincheſter, and has ever been ſo. Next to the prelate is the chancellor; which office is veſted in the biſhop of Saliſbury, who keeps the ſeals, &c. The next is the regiſter, who by his oath is to enter upon the regiſtry, the ſcrutinies, elections, penalties, and other acts of the order, with fidelity. The fourth officer is Garter, and king at arms, being two diſtinct offices united in one perſon. Garter carries the rod and ſceptre at the feaſt of St. George, the protector of this order, when the ſovereign is preſent. He notifies the elections of new knights, attends the ſolemnity of their inſtallations, carries the garter to the foreign princes, &c. He is the principal officer within the college of arms, and chief of the heralds.

All theſe officers, except the prelate, have fees and penſions. The college of the order is ſeated in the caſtle of Windſor, with the chapel of St. George, and the chapter-houſe, erected by the founder for that purpoſe. The habit and enſign of the order are, a garter, mantle, cap, george, and collar. The 4 firſt were aſſigned the knights companions by the founders; and the george and collar by king Henry VIII. The garter challenges pre-eminence over all other parts of the dreſs, by reaſon that from it the noble order is denominated; that it is the firſt part of the habit preſented to foreign princes, and abſent knights, who, and all other knights elect, are therewith firſt adorned; and it is of ſuch honour and grandeur, that by the bare inveſtiture with this noble enſign, the knights are eſteemed companions of the greateſt military order in the world. It is worn on the left leg, between the knee and calf, and is enamelled with this motto, *Honi ſoit qui mal y penſe*; that is, "Shame to him that thinks evil hereof." The meaning of which is, that king Edward having laid claim to the kingdom of France, retorted ſhame and defiance upon him that ſhould dare to think amiſs of the juſt enterpriſe he had undertaken, for recovering his lawful right to that crown; and that the bravery of thoſe knights whom he had elected into this order, was ſuch as would enable him to maintain the quarrel againſt thoſe that thought ill of it.

The mantle is the chief of thoſe veſtments made uſe of upon all ſolemn occaſions. The colour of the mantle is by the ſtatutes appointed to be blue. The length of the train of the mantle, only, diſtinguiſhes the ſovereign from the knights companions. To the collar of the mantle is fixed a pair of long ſtrings, anciently wove with blue ſilk only, but now twiſted round, and made of Venice gold and ſilk, of the colour of the robe, with buttons and taſſels at the end. The left ſhoulder of the mantle is adorned with a large garter, and device *Honi ſoit*, &c. Within this is the croſs of the order, which was ordained to be worn at all times, by king Charles I. At length the ſtar was introduced, being a ſort of croſs irradiated with beams of ſilver.

The collar is compoſed of pieces of gold in faſhion of garters, the ground enamelled blue, and the motto gold.

The garter is of blue velvet bordered with fine gold wire, having commonly the letters of the motto of the ſame: it is, at the time of election, buckled upon the left leg, by 2 of the ſenior companions, who receive it from the ſovereign, to whom it was preſented upon a velvet cuſhion by garter king at arms, with the uſual reverence, whilſt the chancellor reads the following admonition, enjoined by the ſtatutes. "To the honour of God omnipotent, and in memorial of the bleſſed martyr St. George, tie about the leg, for thy renown, this noble garter; wear it as the ſymbol of the moſt illuſtrious order, never to be forgotten, or laid aſide; that thereby thou mayeſt be admoniſhed to be courageous, and having undertaken a juſt war, in which thou ſhalt be engaged, thou mayeſt ſtand firm, valiantly fight, and ſucceſsfully conquer."

The princely garter being thus buckled on, and the words of its ſignification pronounced, the knight elect is brought before the ſovereign, who puts about his neck, kneeling, a ſky-coloured ribbon, whereon is appendant, wrought in gold within the garter, the image of St. George on horſeback, with his ſword drawn, encountering with the dragon. In the mean time the chancellor reads the following ad-

admonition: "Wear this ribbon about thy neck, adorned with the image of the blessed martyr and soldier of Christ, St. George, by whose imitation provoked, thou mayest so overpass both prosperous and adverse adventures, that having stoutly vanquished thy enemies both of body and soul, thou mayest not only receive the praise of this transient combat, but be crowned with the palm of eternal victory."

Then the knight elected kisses his sovereign's hand, thanks his majesty for the great honour done him, rises up, and salutes all his companions severally, who return their congratulations.

Since the institution of this order, there have been 8 emperors, and 28 kings, besides numerous sovereign princes, enrolled as companions thereof. Its origin is somewhat differently related: the common account is, that it was erected in honour of a garter of the countess of Salisbury, which she dropped dancing with king Edward, and which that prince picked up; but our best antiquaries think it was instituted on account of the victory over the French at Cressy, where the king ordered his garter to be displayed as a signal of the battle.

GATE, in a *military sense*, is made of strong planks with iron bars to oppose an enemy. They are generally made in the middle of the curtain, from whence they are seen and defended by the 2 flanks of the bastions. They should be covered with a good ravelin, that they may not be seen or enfiladed by the enemy. The palisades and barriers before the gates within the town are often of great use. The fewer ports there are in a fortress, the more you are secured against the enemy. At the opening of a gate, a party of horse is sent out to patrole in the country round the place, to discover ambuscades or lurking parties of the enemy, and to see if the country be clear.

GAUNTELOPE. } See Gantlope. *Run the*
GAUNTLET. } Gantlope.

GAZONS, in *fortification*, are pieces of fresh earth or sods, covered with grass, and cut in form of a wedge, about a foot long, and half a foot thick, to line the outsides of a work made of earth; as ramparts, parapets, banquettes, &c. The first bed of gazons is fixed with pegs of wood; and the second bed is so laid as to bind the former, by being placed over its joints; and so continued 'till the works are finished. Betwixt those sods it is usual to sow all sorts of binding weeds or herbs, in order to strengthen the rampart.

GENDARMES, } in the *French armies*, a
GENS D'ARMES, } denomination given to a select body of horse, on account of their succeeding the ancient gendarmes, who were thus called from their being completely clothed in armour. These troops are commanded by captain-lieutenants; the king, and the princes of the blood, being their captains: the king's troop, besides a captain-lieutenant, has 2 sub-lieutenants, 3 ensigns, and 3 guidons. Established in France in 1422.

Grand Gendarmes, at present are a troop composed of 250 gentlemen: the king himself is their captain, and one of the first peers their captain-lieutenant, who has under him 2 lieutenants, 3 ensigns, 3 guidons, and other officers.

Small Gendarmery, are the Scotch gendarmes, the queen's, the dauphin's, the gendarmes of Anjou, Burgundy, the English and Flemish gendarmes, having each a captain-lieutenant, sub-lieutenant, ensign, guidon, and quarter-master.

GENERAL, in a *military sense*, is an officer in chief, to whom the prince has judged proper to intrust the command of his troops; and this, whether he is known by the name of Captain-general, as in England and Spain, Feldt mareschal, as in Germany, or Mareschal, as in France.

The natural qualities of a General, should be a martial genius, a solid judgement, a healthy robust constitution, intrepidity and presence of mind on critical occasions, indefatigability in business, goodness of heart, liberality, birth; the more illustrious it is, the more it commands respect: a reasonable age; if too young, he may want experience and prudence; if too old, he may not have vivacity enough: an uniform conduct, an affable humour, but inflexible in maintaining the police and discipline of an army.

Acquired qualities of a General, are secrecy, justice, sobriety, temperance, knowledge of the art of war from theory and practice, the art of commanding, and speaking with precision and exactness; great attention to preserve the lives and supply the wants of the soldiers, and a constant study of the characters of the officers of his army, that he may employ them according to their talents. His conduct appears in establishing his magazines in the most convenient places; in examining the country, that he may not engage his troops too far, while he is ignorant of the means of bringing them off; in subsisting them, and in knowing how to take the most advantageous posts,

posts, either for fighting, retreating, or shunning a battle. His experience inspires his army with confidence, and in assurance of victory; and his quality, by creating respect, augments his authority. By his liberality he gets intelligence of the strength and designs of the enemy, and by this means is enabled to take the most successful measures. He ought to be fond of glory, to have an aversion to flattery, to render himself beloved, and to keep a strict discipline and a regular subordination.

The office of a GENERAL, is to regulate the march and encampment of the army; in the day of battle to chuse out the most advantageous ground; to make the disposition of the army; to post the artillery, and, where there is occasion, to send his orders by his aids-de-camp. At a siege he is to cause the place to be invested, to regulate the approaches and attacks, to visit the works, and to send out detachments to secure the convoy, and foraging parties.

GENERAL, is also used for a particular beat of the drum. See DRUM.

GENERALISSIMO, a supreme and absolute commander in the field. This word is generally used in most foreign languages. (See GENERAL.) It was first invented by the absolute authority of cardinal Richelieu, when he went to command the French army in Italy.

GENERAL *of the artillery*. See ORDNANCE.

GENERALS *of horse*, are posts next under the general of the army. They have an absolute command over the horse of an army, above the lieutenant-generals.

GENERALS *of foot*, are posts next under the general of the army, having an absolute command over the foot of the army. See GENERAL.

Adjutant-GENERAL, one who attends the general, assists in council, and carries the general's orders to the army. He distributes the daily orders to the majors of brigade. He is likewise charged with the general detail of the duty of the army. The majors of brigade send every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade. In a day of battle the adjutant-general sees the infantry drawn up; after which, he places himself by the general, to receive any orders which may regard the corps of which he has the detail. In a siege, he orders the number of workmen demanded, and signs the warrants for their payment. He receives the guards of the trenches at their rendezvous, and examines their condition; he gives and signs all orders for parties. He has an orderly serjeant from each brigade of infantry in the line, to carry such orders as he may have occasion to send from the general.

Lieutenant-GENERAL, is the next in command after the general; and provided he should die or be killed, the order is, that the oldest lieutenant-general shall take the command. This office is the first military dignity after that of a general. One part of their function is, to assist the general with their counsel: they ought therefore, if possible, to possess the same qualities with the general himself, and the more, as they often command armies in chief.

The number of lieutenant-generals have been multiplied of late in Europe, in proportion as the armies have become numerous. They serve either in the field, or in sieges, according to the dates of their commissions. In battle the oldest commands the right wing of the army, the second the left wing, the third the centre, the fourth the right wing of the second line, the fifth the left wing, the sixth the centre, and so on. In sieges the lieutenant-generals always command the right of the principal attack, and order what they judge proper for the advancement of the siege, during the 24 hours they are in the trenches, except the attacks, which they are not to make without an order from the general in chief.

Lieutenant-GENERAL *of the ordnance*. See ORDNANCE.

Lieutenant-GENERAL *of artillery*, is, or ought to be, a very great mathematician, and an able engineer, to know all the powers of artillery, to understand the attack and defence of fortified places, in all its different branches; how to dispose of the artillery in the day of battle to the best advantage; to conduct its march and retreat; as also to be well acquainted with all the numerous apparatus belonging to the train, and to the laboratory, &c.

Major-GENERAL, the next officer to the lieutenant-general: his chief business is to receive orders from the general, or in his absence from the lieutenant-general of the day; which he is to distribute to the brigade-majors, with whom he is to regulate the guards, convoys, detachments, &c. On him the whole fatigue and detail of duty of the army roll. It is the major-general of the day who is charged with the encampment of the army, who places himself at the head of it when they march, who marks out the ground of the camp to the quarter-master-general, and who places the new guards for the safety of the camp.

The day the army is to march, he dictates to the field-officers the order of the march, which he

he has received from the general, and on other days gives them the parole.

In a fixed camp he is charged with the foraging, with reconnoitring the ground for it, and poſting the eſcorts, &c.

In ſieges, if there are two ſeparate attacks, the ſecond belongs to him; but if there is but one, he takes either from the right or left of the attack, that which the lieutenant-general has not choſen.

When the army is under arms, he aſſiſts the lieutenant-general, whoſe orders he executes.

If the army marches to an engagement, his poſt is at the head of the guards of the army, until they are near enough to the enemy to rejoin their different corps; after which he retires to his own proper poſt; for the major-generals are diſpoſed on the order of battle as the lieutenant-generals are, to whom, however, they are ſubordinate, for the command of their diviſions. The major-general has one aid-de-camp, paid for executing his orders.

GENIUS, in a *military ſenſe*, a natural talent or diſpoſition to every kind of warlike employment, more than any other; or the aptitude a man has received from nature to perform well, and eaſily, that which others can do but indifferently, and with a great deal of pains.

From the diverſity of genius, the difference of inclination ariſes in men, whom Nature has had the precaution of leading to the employments for which ſhe deſigns them, with more or leſs impetuoſity, in proportion to the greater or leſſer number of obſtacles they have to ſurmount, in order to render themſelves capable of anſwering this occaſion. Thus the inclinations of men are ſo very different, becauſe they follow the ſame mover, that is, the impulſe of their genius. This, as with the general in chief, is what renders one officer more pleaſing, even though he treſpaſſes againſt the rules of war; while others are diſagreeable, notwithſtanding their ſtrict regularity.

GENOUILLIERE. See FORTIFICATION.

GENS D'ARMES. See GENDARMES.

GEODŒSIA. See SURVEYING.

GEOGRAPHY, is the doctrine or knowledge of the terreſtrial globe; or the ſcience that teaches and explains the ſtate of the earth, and parts thereof that depend upon quantity: or it is rather that part of mixed mathematics, which explains the ſtate of the earth, and of its parts depending on quantity, viz. its figure, magnitude, place, and motion, with the celeſtial appearances, &c. In conſequence of this definition, geography ſhould be divided into general and ſpecial, or univerſal and particular.

By univerſal GEOGRAPHY, is underſtood that part of the ſcience which conſiders the whole earth in general, and explains its properties without regard to particular countries. This diviſion is again diſtinguiſhed into 3 parts, abſolute, relative, and comparative. The abſolute part reſpects the body of the earth itſelf, its parts and peculiar properties; as its figure, magnitude, and motion; its lands, ſeas, and rivers, &c. The relative part accounts for the appearances and accidents that happen to it from celeſtial cauſes; and, laſtly, the comparative contains an explanation of thoſe properties which ariſe from comparing different parts of the earth together.

Special or *particular* GEOGRAPHY, is that diviſion of the ſcience which deſcribes the conſtitution and ſituation of each ſingle country by itſelf; and is two-fold, viz. chorographical, which deſcribes countries of a conſiderable extent; or topographical, which gives a view of ſome place, or ſmall tract of land. Hence the object or ſubject of geography is the earth, eſpecially its ſuperficies and exterior parts.

The properties of GEOGRAPHY are of 3 kinds, viz. celeſtial, terreſtrial, and human. The celeſtial properties are ſuch as affect us by reaſon of the apparent motion of the ſun and ſtars. Theſe are 8 in number.

1. The elevation of the pole, or the diſtance of a place from the equator.

2. The obliquity of the diurnal motion of the ſtars above the horizon of the place.

3. The time of the longeſt and ſhorteſt day.

4. The climate and zone.

5. Heat, cold, and the ſeaſons of the year; with rain, ſnow, wind, and other meteors.

6. The riſing, appearance, and continuance of ſtars above the horizon.

7. The ſtars that paſs through the zenith of a place.

8. The celerity of the motion with which, according to the Copernican hypotheſis, every place conſtantly revolves.

The terreſtrial properties are thoſe obſerved in the face of each country, and are likewiſe 10 in number.

1. The limits and bounds of each country;

2.–6. Its { figure; magnitude; mountains; waters, viz. ſprings, rivers, lakes, and bays; woods and deſerts;

7. The fruitfulneſs and barrenneſs of the country, with its various kinds of fruits;

8. The

8. minerals and foſſils;
9. The living creatures there;
10. longitude and latitude of the place.

The third kind of obſervations to be made in every country is called human, becauſe they chiefly regard the inhabitants of the place; and theſe are alſo 10 in number.

1. Their ſtature, ſhape, colour, and the length of their lives; their origin, meat and drink.

2. Their arts, and the profits which ariſe from them, with the merchandize they barter one with another.

3. Their virtues and vices, learning, capacities, and ſchools.

4. Their ceremonies at births, marriages, and funerals.

5. The language which the inhabitants uſe.

6. political government.
7. Their religion and church government.
8. cities and famous places.
9. remarkable hiſtories & antiquities

10. Their famous men, artificers, and inventions of the natives.

Theſe are the three kinds of occurrences to be explained in ſpecial geography.

The principles of Geography, or thoſe from which arguments are drawn for proving of propoſitions in that ſcience, are, according to the beſt authors, of three ſorts:

1. Geometrical, arithmetical, and trigonometrical propoſitions.

2. Aſtronomical precepts and theorems.

3. Experience, being that upon which the greateſt part of geography, and chiefly the ſpecial, is founded.

In proving geographical propoſitions, we are to obſerve, that ſeveral properties, and chiefly the celeſtial, are confirmed by proper demonſtrations; being either grounded on experience and obſervation, or on the teſtimony of our ſenſes: nor can they be proved by any other means. There are alſo ſeveral propoſitions proved, or rather expoſed to view, by the terreſtrial globe, or by geographical maps.

Other propoſitions cannot be ſo well proved, yet are received as apparent truths. Thus, though we ſuppoſe all places on the globe, and in maps, to be laid down in the ſame order as they are really on the earth; nevertheleſs, in theſe matters, we rather follow the deſcriptions that are given by geographical writers.

Geography is very ancient, at leaſt the ſpecial part thereof; for the ancients ſcarce went beyond the deſcription of countries. It was a conſtant cuſtom among the Romans, after they had conquered or ſubdued any province, to have a map or printed repreſentation thereof, carried in triumph, and expoſed to the view of the ſpectators. Hiſtorians relate, that the Roman ſenate, about 100 years before Chriſt, ſent geographers into divers parts to make an exact ſurvey and menſuration of the whole globe; but they ſcarce ever ſaw the 20th part of it.

Before them, Necho, king of Egypt, ordered the Phænicians to make a ſurvey of the whole coaſt of Africa, which they accompliſhed in 3 years. Darius procured the Ethiopic ſea, and the mouth of the Indus, to be ſurveyed; and Pliny relates, that Alexander, in his expedition into Aſia, took 2 geographers to meaſure and deſcribe the roads; and that from their itineraries, the writers of the following ages took many particulars. Indeed this may be obſerved, that whereas moſt other arts and ſciences are ſufferers by war, geography, artillery, mining, and fortification, alone have been improved thereby. Geography, however, muſt have been exceedingly defective, as a great part of the globe was then unknown, particularly all America, the northern parts of Europe and Aſia, with the Terra Auſtralis, and Magellanica; and they were alſo ignorant of the earth's being capable to be ſailed round, and of the torrid zone's being habitable, &c.

The honour of reducing geography to art and ſyſtem, was reſerved for Ptolemy, who, by adding mathematical advantages to the hiſtorical method in which it had been treated of before, has deſcribed the world in a much more intelligible manner: he has delineated it under more certain rules, and by fixing the bounds of places from longitude and latitude, hath diſcovered other miſtakes, and has left us a method of diſcovering his own.

GEOMETRY, originally ſignified no more than the art of meaſuring the earth, or any diſtances or dimenſions within it; but at preſent it denotes the ſcience of magnitude in general; comprehending the doctrine and relations of whatever is ſuſceptible of augmentation or diminution, conſidered in that light. Hence, to geometry may be referred the conſideration not only of lines, ſurfaces and ſolids; but alſo of time, velocity, number, weight, &c.

Plato thought the word geometry an improper name for this ſcience, and accordingly ſubſtituted in its place the more extenſive one of menſuration; and, after him, others gave it the name of pantometry, as demonſtrating not only the quantities of all manner of magnitudes, but alſo their qualities, ratios, poſitions, transformations, relations, &c. and Proclus calls it the knowledge of magnitudes and figures, and their limitations; alſo of their motions, and affections of every kind.

Origin

Origin and progress of GEOMETRY. This ſcience had its riſe among the Egyptians, who were in a manner compelled to invent it, to remedy the confuſion which generally happened in their lands, from the inundations of the river Nile, which carried away all their boundaries, and effaced all the limits of their poſſeſſions. Thus, this invention, which at firſt conſiſted only in meaſuring the lands, that every perſon might have what belonged to him, was called geometry, or the art of meaſuring land; and it is probable, that the draughts and ſchemes, which they were annually compelled to make, helped them to diſcover many excellent properties of theſe figures; which ſpeculations continued to be gradually improved, and are ſo to this day.

From Egypt geometry paſſed into Greece, where it continued to receive new improvements in the hands of Thales, Pythagoras, Archimedes, Euclid, &c. The elements of geometry, written by this laſt in 15 books, are a moſt convincing proof to what perfection this ſcience was carried among the ancients. However, it muſt be acknowledged, that it fell ſhort of modern geometry, the bounds of which, what by the invention of fluxions, and the diſcovery of the almoſt infinite order of curves, are greatly enlarged.

Diviſion of GEOMETRY. This ſcience is uſually diſtinguiſhed into elementary, and higher or ſublime geometry. The firſt, or elementary geometry, treats of the properties of right lines, and of the circle, together with the figures and ſolids formed by them. The doctrine of lines comes firſt, then that of ſurfaces, and laſtly that of ſolids. The higher geometry comprehends the doctrine of conic ſections, and numerous other curves.

Speculative and practical GEOMETRY. The former treats of the properties of lines and figures, as Euclid's Elements, Apollonius's Conic Sections, &c. and the latter ſhews how to apply theſe ſpeculations to the uſe of menſuration, navigation, ſurveying, taking heights and diſtances, gauging, fortification, gunnery, &c.

Uſefulneſs of GEOMETRY. The uſefulneſs of this ſcience extends to almoſt every art and ſcience. It is by the help of it that aſtronomers turn their obſervations to advantage; regulate the duration of times, ſeaſons, years, cycles, and epochas; and meaſure the diſtances, motion, and magnitudes, of the heavenly bodies. It is by it that geographers determine the figure and magnitude of the whole earth; and delineate the extent and bearings of kingdoms, provinces, harbours, &c. It is from this ſcience alſo, that architects derive their juſt meaſure and conſtruction of public edifices, as well as private houſes.

It is by the aſſiſtance of geometry that engineers conduct all their works, take the ſituation and plans of towns, the diſtances of places, and the meaſure of ſuch things as are only acceſſible to the ſight. It is not only an introduction to fortification, but highly neceſſary to moſt mechanics. On geometry likewiſe depends the theory of gunnery, mining, muſic, optics, perſpective, drawing, mechanics, hydraulics, pneumatics, &c.

GEORGE, *or Knight of St. George*, has been the denomination of ſeveral military orders, whereof that of the garter is one of the moſt illuſtrious. See GARTER.

GIN, in *military mechanics*, is a machine for raiſing great weights: it is compoſed of three long legs, two of which are kept at a proper diſtance by means of two iron bars fixed on one of the legs by a ſtaple paſſing through the hole at one end: the other end has a hook which enters into a ſtaple fixed into the other leg, ſo as to put off or on at pleaſure. At 3 feet from the bottom is a roller, upon which the cable is wound; and the 3 legs are joined together with an iron bolt, about which they move: to this bolt is alſo fixed an iron half-ring to hook on a windlaſs: when the gin ſtands upright, ſo as the legs ſtand at a proper diſtance, one end of the cable is faſtened to a gun, mortar, or other weight; and the other paſſes through the pullies and round the roller, which is turned round by means of hand-ſpikes paſſing through the holes in the ends of the roller: whilſt a man holds the cable tight, the gun is raiſed to the height that the carriage may be put under it.

GLACIS. See FORTIFICATION.

GLOBE. See GEOGRAPHY.

GORGE. See FORTIFICATION.

GORGET, a kind of breaſt-plate, like a half-moon, with the arms of the prince thereon; worn by the officers of foot. They are to be either gilt or ſilver, according to the colour of the buttons on the uniforms.

GORGONS, in *military antiquity*, a warlike female nation of Lybia, in Africa, who had frequent quarrels with another nation of the ſame ſex, called *Amazons*.

GOVERNOR *of a fortification*, is, or ſhould be,

be, a person of great military knowledge; and is, however, a very considerable officer, representing the king's person, whose authority extends not only over the inhabitants and garrison, but over all troops that may be there in winter quarters, cantonments, or quarters of refreshment.

Duty of a GOVERNOR *in time of peace*, is to order the guards, the rounds, and the patroles; to give the parole and countersign every night after the gates are shut; to visit the posts, to see that both officers and soldiers do their duty, and to see that every thing goes on regularly, and in good order.

Duty of a GOVERNOR *in time of war*. He should consider the place in such a manner, as if the enemy were going to besiege him, not omitting the least thing that may contribute to a long and obstinate defence: he should therefore take particular care to keep the fortification in good repair; clearing the country round of all hedges, ditches, trees, hollow roads, caverns, and rising grounds, within the reach of cannon-shot; not suffering any houses to be built within that distance, nor in general any thing to be done that may favour the approach of an enemy.

He should consider well with himself every minute circumstance that may be of advantage to him during the siege: he should thoroughly examine the several works, and canvass all the different stratagems that may be used, either to defend them, or to give way upon occasion, when overpowered, with an intent to return and dislodge the enemy, after they have got possession of them; in short, how to defend the place entrusted to his care, inch by inch, with the best advantage. He should consider how, and in what manner, the works defend each other; whether their communications are safe, or if they may be interrupted by the besiegers; how to incommode the enemy when they are at a distance, or to dislodge them when near; if the ground be proper for mines, and where they should be made; if any part of the country may not be laid under water, by means of dikes or sluices: if there are any already made, to keep them in constant repair, or to make them if they are wanted; taking care to construct them so that the enemy may not have it in their power to destroy them, either with their cannon or mortars.

If the governor is not sufficiently skilled in the attack and defence, he should frequently converse with the officers of engineers and artillery who understand it, examine the works together, to see what may be done to render the defence of the place as long as the circumstances and nature of the works will admit of: and to make it familiar to himself, he should set down a project of defence on paper, and have it canvassed by the most skilful officers of artillery, and engineers, about him. This must be done in private, that spies or deserters may not discover the weak parts to the enemies. In short, nothing should be neglected on the part of the governor.

He should see that the place be well supplied with plenty of ammunition, and wholesome provisions; that the hospitals are in good order, and provided with able physicians and surgeons, as likewise with every thing wholesome and necessary, that the sick and wounded may be well taken care of.

The powder-magazines, above all things, require his most special care: though they are built bomb-proof, yet, when a great number of shells fall upon them, they seldom resist their shock; for which reason they should be covered with 8 or 10 feet thick of earth, and a layer of fascines, dung and strong planks laid over them.

GRANADIER, } GRENADIER, } a foot soldier, armed with a firelock, bayonet, and hanger: they carry, besides their arms, a cartridge-box that will hold 24 rounds, and a pouch filled with hand-grenades. They are clothed differently from the rest of the battalion they belong to, by wearing a high cap, fronted with a plate of brass, on which the king's arms is generally represented, &c. and a piece of cloth upon their shoulders, called a wing: even in some armies they have more pay than a common soldier. They are always the tallest and briskest men, consequently the first upon all attacks. Every battalion of foot has generally a company of grenadiers belonging to it, which takes always the right of the battalion. Grenadiers were first instituted in France in 1667, by having 4 or 5 to each company; but in the year 1670, they were formed into companies, and in 1685, first known in England.

Horse-GRENADIERS, called by the French *grenadiers volans*, or flying-grenadiers, are such as are mounted on horseback, but fight both on foot and horseback. They were first established in France by Lewis XIV. in 1676, and formed into squadrons. We have in England

two

two troops of horse-grenadier guards, the first raised in the year 1693, and the command given to lieutenant-general Cholmondeley; the second in 1702, and the command given to lord Forbes.

GRANADES, GRENADES, in the *art of war*, are hollow balls or shells, of iron or other metal, about 2½ inches diameter, which, being filled with fine powder, are set on fire, by means of a small fuze, driven into the fuze-hole, made of well-seasoned beech wood, and thrown by the grenadiers into such places where men stand thick, and particularly into the trenches and other lodgements made by the enemy. As soon as the composition within the fuze gets to the powder in the grenade, it bursts into many pieces, greatly to the damage of all who happen to be in its way. Grenades were first invented about the time shells were invented (which see) and first used in 1594. Grenades have unaccountably sunk into disuse; but I am persuaded there is nothing more proper than to have grenades to throw into the midst of the enemy, who have jumped into the ditch. During the siege of Cassel, under the Count de la Lippe, in the campaign of 1762, a young engineer undertook to carry one of the outworks, with a much smaller detachment than one which had been repulsed, and succeeded with ease, from the use of grenades; which is a proof that they should not be neglected, either in the attack or defence of posts.

GRAPE-*shot*. See SHOT.

GRAPPLING-*irons*, in the *art of war*, are composed of 4, 5, or 6 branches, bent round and pointed, with a ring at the root, to which is fastened a rope to hold by, when the grapple is thrown at any thing, in order to bring it near, so as to lay hold of it.

GROUND. See BREAK.

GROUND-*work*, in *military architecture*. See FOUNDATION.

GUARD, in the *military art*, is a duty performed by a body of men, to secure an army or place from being surprised by an enemy. In garrison the guards are relieved every day; hence it comes that every soldier mounts guard once every 3 or 4 days in time of peace, and much oftener in time of war. See HONOURS.

Advanced GUARD, is a party of either horse or foot, that marches before a more considerable body, to give notice of any approaching danger. These guards are either made stronger or weaker, according to the situation or danger you may apprehend from the enemy, or the country you are to march through.

Van GUARD. See ADVANCED GUARD.

Artillery GUARD, is a detachment from the army to secure the artillery when in the field. Their corps de garde is in the front of the artillery park, and their centries dispersed round the same. This is generally a 48-hours guard; and upon a march, this guard marches in the front and rear of the artillery, and must be sure to leave nothing behind: if a gun or waggon breaks down, the officer that commands the guard is to leave a sufficient number of men to assist the gunners and matrosses in getting it up again.

Artillery quarter-GUARD, is frequently a non-commissioned officer's guard from the royal regiment of artillery, whose corps de garde is always in the front of their incampment.

Artillery rear-GUARD, consists in a corporal and 6 men, posted in the rear of the park.

Corps de GARDE, are soldiers entrusted with the guard of a post, under the command of one or more officers. This word also signifies the place where the guard mounts.

Counter GUARD. See FORTIFICATION.

Grand GUARD, three or four squadrons of horse, commanded by a field-officer, posted at about a mile, or a mile and a half from the camp, on the right and left wings, towards the enemy, for the better security of the camp.

Forage GUARD, a detachment sent out to secure the foragers, who are posted at all places, where either the enemy's party may come to disturb the foragers, or where they may be spread too near the enemy, so as to be in danger of being taken. This guard consists both of horse and foot, and must remain on their posts 'till the foragers are all come off the ground.

Main GUARD, is that from whence all other guards are detached. Those who are for mounting guard assemble at their respective captain's quarters, and march from thence to the parade in good order; where, after the whole guard is drawn up, the small guards are detached to their respective posts: then the subalterns throw lots for their guards, who are all under the command of the captain of the main guard. This guard mounts in garrison at different hours, according as the governor pleases.

Picquet GUARD, a good number of horse and foot, always in readiness in case of an alarm: the horses are generally saddled all the time, and the riders booted.

The foot draw up at the head of the battalion, frequently at the beating of the tat-too; but afterwards return to their tents, where they hold themselves in readiness to march, upon

 any

any sudden alarm. This guard is to make resistance, in case of an attack, until the army can get ready.

Baggage GUARD, is always an officer's guard, who has the care of the baggage on a march. The waggons should be numbered by companies, and follow one another regularly: vigilance and attention in the passage of hollow-ways, woods, and thickets, must be strictly observed by this guard.

Ordinary GUARDS, such as are fixed during the campaign, and relieved daily.

Extraordinary GUARDS, or detachments, which are only commanded on particular occasions; either for the further security of the camp, to cover the foragers, or for convoys, escorts, or expeditions.

Quarter GUARD, is a small guard commanded by a subaltern officer, posted in the front of each battalion, at 222 feet before the front of the regiment.

Rear GUARD, that part of the army which brings up the rear on a march, generally composed of all the old grand-guards of the camp.

The rear guard of a party is frequently 8 or 10 horse, about 500 paces behind the party. Hence the advance guard going out upon a party, form the rear guard in their retreat.

Rear GUARD, is also a corporal's guard placed in the rear of a regiment, to keep good order in that part of the camp.

Standard GUARD, a small guard under a corporal, out of each regiment of horse, who mount on foot in the front of each regiment, at the distance of 20 feet from the streets, opposite the main street.

GUARDS, also imply the troops kept to guard the king's person, and consist of both horse and foot.

Horse GUARDS, in England, are gentlemen chosen for their bravery and fidelity, to be entrusted with the guard of the King's person; and are divided into 4 troops, called the 1st, 2d, 3d, and 4th troop of horse-guards. The first troop was raised in the year 1660, and the command given to lord Gerrard; the second in 1659, and the command given to Sir Philip Howard; the third in 1665, and the command given to Earl Feversham; the fourth in 1660, and the command given to Earl Newburgh. Each troop has a colonel, 2 lieutenant-colonels, 1 cornet and major, 1 guidon and major, 4 exempts and captains, 4 brigadiers and lieutenants, 1 adjutant, 4 sub-brigadiers and cornets, and 60 private men.

Horse-grenadier GUARDS, are divided into 2 troops, called the 1st and 2d troops of horse-grenadier guards. The first troop was raised in the year 1693, and the command given to lieutenant-general Cholmondeley; the second in 1702, and the command given to lord Forbes. Each troop has a colonel, lieutenant-colonel, 1 guidon or major, 3 exempts and captains, 3 lieutenants, 1 adjutant, 3 cornets, and 60 private men.

Yeomen of the GUARD, first raised by Henry VII. in the year 1485: they are a kind of pompous foot-guards to the king's person, and are generally called by a nick-name, the *beef-eaters*. They were anciently 250 men of the first rank under gentry, and of larger stature than ordinary, each being required to be 6 feet high. At present there are but 100 in constant duty, and 70 more not on duty; and when any one of the 100 dies, his place is supplied out of the 70. They go dressed after the manner of king Henry VIII's time. Their first commander or captain was the earl of Oxford, and their pay is 2 shillings and 6 pence per day.

Foot GUARDS, are regiments of foot appointed for the guard of his majesty, and his palace. There are 3 regiments of them, called the 1st, 2d, and 3d regiment of foot-guards. They were raised in the year 1660, and the command of the first given to colonel Russel, that of the second to general Monk, and the third to the earl of Linlithgow. The first regiment is at present commanded by 1 colonel, 1 lieutenant-colonel, 3 majors, 23 captains, 1 captain-lieutenant, 31 lieutenants, and 24 ensigns; and contains 3 battalions. The second regiment has 1 colonel, 1 lieutenant-colonel, 2 majors, 14 captains, 1 captain-lieutenant, 18 lieutenants, 16 ensigns; and contains only 2 battalions. The third regiment is the same as the second. The first regiment of French guards was raised in the reign of Charles IX, in the year 1563.

Trench GUARD, only mounts in the time of a siege, and consists sometimes of 3, 4 or 6 battalions, according to the importance of the siege. This guard must oppose the besieged when they sally out, protect the workmen, &c.

Provost GUARD, is always an officer's guard that attends the provost in his rounds, either to prevent desertion, maroding, rioting, &c. See PROVOST.

GUARD-*Magazine*. See STORE-KEEPER.

To be upon GUARD,—*To mount guard,—To relieve the guard,---The officer or serjeant of the guard*, are phrases respecting the guard, and that every one knows.

GUARD, in *fencing*, implies a posture proper to

to defend the body from the sword of the antagonist.

GUERITTE, in *ancient military history*, is a centry-box, or centinel's box. See CENTRY-BOX.

GUIDES, in *military affairs*, are generally the country people in the neighbourhood where the army incamps: they are to give you intelligence concerning the country, the roads by which you are to march, and the route the enemy may take to come to you. Guides should be faithful, because, in giving you false intelligence, or guiding you wrong, they may greatly endanger the army. Several guides are requisite, as every corps that marches by night should have one at least. There is sometimes a captain, or chief of the guides, who should be a man of parts, active, and attentive to the diligence and fidelity of his people. He should always have a sufficient number with him, and who are well acquainted with the country.

GUIDEFORE. See WAGGON.

GUIDEHIND. See WAGGON.

GUIDON, in *ancient military history*, the name of a sort of standard carried by the king's life-guards; so called from its being broad at one extreme, and almost pointed at the other, and slit, or divided into two.

GUIDON, also implies the officer who carries the guidon or standard.

GUN, a fire-arm, or weapon of offence, which forcibly discharges a bullet through a cylindrical barrel, by means of gun-powder. See MUSKET.

Evening-GUN, is generally a 12-pounder, which fires every night about sun-set, and every morning at sun-rise, to give notice to the drums and trumpets of the army, to beat and sound the retreat and the reveille.

Great GUN. See CANNON.

GUNNER, in the *artillery*, is the second rank of private men in the royal regiment of artillery.

Master GUNNER, one who teaches the men on ship-board to load and fire the guns: he is also a patent officer of the ordnance in garrisons.

GUNNERY, the art of determining the motions of bodies shot from cannon, mortars, howitzers, &c. See the article PROJECTILE.

The late ingenious Mr. Robins, having concluded from experiments, that the force of fired gun-powder, at the instant of its explosion, is the same with that of an elastic fluid of a thousand times the density of common air, and that the elasticity of this fluid, like that of the air, is proportional to its density, proposes the following problem.

The dimensions of any piece of artillery, the weight of its ball, and the quantity of its charge being given; to determine the velocity which the shot will acquire from the explosion, supposing the elasticity or force of the powder at the first instant of its firing to be given.

In the solution of this important problem, he assumes the two following principles: 1. That the action of the powder on the shot ceases as soon as it is got out of the piece. 2. That all the powder of the charge is fired, and converting into an elastic fluid, before the shot is sensibly moved from its place.

These assumptions, and the conclusions above mentioned, make the action of fired gun-powder to be entirely similar to that of air condensed a thousand times; and from thence it will not be difficult to determine the velocity of the shot arising from the explosion: for the force of the fired powder diminishing in proportion to its expansion, and ceasing when it is got out of the piece; the total action of the powder may be represented by the area of a curve, the base of which represents the space through which the ball is accelerated, while the ordinates represent the force of the powder at every point of that space; and these ordinates being in reciprocal proportion to their distance from the breech of the gun, because when the spaces occupied by the fired powder are as 1, 2, 3, 4, &c. the ordinates representing it will be as 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. it appears that the curve will be a common parabola, and that the area intercepted between it, its asymptote, and the two ordinates representing the force of the powder at the first explosion, and at the muzzle of the piece, will represent the total action of the powder on the shot: but if the shot were urged through the same space by an uniform force equal to its gravity, the total action of this force would be represented by a rectangle, the base of which would be the base of the curve or intercepted portion of the asymptote above mentioned, and the height of which would represent the uniform force of gravity. Hence the square of the velocity of the shot resulting from gravity is given, being the velocity it would acquire from a height equal to the space through which the powder accelerates it; and the proportion between the hyperbola and the rectangle is given from the analogy between the hyperbolic paces and logarithms; therefore the velocity of the ball arising from the action of the fired gun-powder will be given.

Mr. Robins has also given us an ingenious way of determining, by experiments, the velocity which any shot moves with at any distance of the piece it is charged from.

This

This may be effected by means of a pendulum made of iron, having a broad part at bottom, covered with a thick piece of wood, which is fastened to the iron by screws; then having a machine like a common artillery-gin, on two of which poles, towards their tops, are screwed sockets, on which the pendulum is hung by means of a cross piece, which becomes its axis of suspension, and on which it should vibrate with great freedom. Something lower than the bottom of the pendulum there should be a brace, joining to which the pendulum is suspended; and to this brace there is fastened a contrivance made with two edges of steel, something in the manner of a drawing-pen; the strength with which these edges press on each other, being diminished or increased at pleasure, by means of a screw. To the bottom of the pendulum should be fastened a narrow ribbon, which, passing between the steel edges, may hang loosely down by means of an opening cut in the lower piece of steel.

The instrument being thus fitted, if the weight of the pendulum, the respective distances of its centre of gravity, and of its centre of oscillation from the axis of suspension, be known, it may from thence be found, what motion will be communicated to this pendulum by the percussion of a body of a known weight, moving with a known degree of velocity, and striking it in a given point; that is, if the pendulum be supposed to rest before the percussion, it will be known what vibration it should make in consequence of such a blow; and if the pendulum, being at rest, is struck by a body of a known weight, and the vibration which the pendulum makes after the stroke is known, the velocity of the striking body may from thence be determined.

Now, the extent of the vibration, made by the pendulum, may be increased by the ribbon: for if the pressure of the steel edges on the ribbon be regulated by the screw, so as to be free and easy, though with some minute resistance to hinder it from slipping of itself; then setting the pendulum at rest, let the part of the ribbon between the pendulum and the steel edges be drawn strait, but not strained, and fixing a pin in the part of the ribbon contiguous to the edges, the pendulum, swinging back by means of the impulse of the ball, will draw out the ribbon to the just extent of its vibration, which will be determined by the interval on the ribbon between the edges and the space of the pin.

The computation by which the velocity of the shot is determined from the vibration of the pendulum, after the stroke, is founded on this principle of mechanics; that if a body in motion strikes another at rest, and they are not separated after the stroke, but move on with one common motion, then that common motion is equal to the motion with which the first body moved before the stroke: whence, if that common motion and the masses of the two bodies are known, the motion of the first body before the stroke is thence determined. On this principle it follows, that the velocity of a shot may be diminished in any given ratio, by its being made to impinge on a body of weight properly proportioned to it.

It is to be observed, that the length to which the ribbon is drawn, is always near the chord of the arc described by the ascent; it being so placed, as to differ insensibly from these chords which must frequently occur; and these chords are known to be in the proportion of the velocities of the pendulum acquired from the stroke. Hence it follows, that the proportion between the lengths of the ribbon, drawn out at different times, will be the same with that of the velocities of the impinging shots.

Now from the computations delivered by Mr. Robins, it appears, that the velocity of the bullet was 1641 feet in one second of time, when the chord of the arc described by the ascent of the pendulum, in consequence of the blow, was 17¼ inches, the proportion of the velocity with which the bullets impinge, to the known velocity of 1641 feet in one second, will be determined.

Mr. Robins is, I think (till of late) the only author who has attempted to ascertain the velocity of a military projectile, by experiment; yet his conclusions seem to be unsatisfactory. Perhaps he was too much attached to the forming of a system, and warped his experiments a little in favour of it. The resisting power he assigns to the air is probably too great; and his notion of the tripling of this power when the velocity of the projectile exceeds that of sound, seems to be rather an ingenious conceit than a well-grounded fact. However, experiment alone must decide these points.

Experiments to determine the projectile curve, and velocity of the curve. Plate XII. fig. 1.

1. Let there be prepared, with great accuracy, a mortar, a solid shot, and a sufficient quantity of powder, in order to preserve an uniform force as nearly as possible.

2. Chuse a convenient situation, and let

RABCr be a horizontal plane, and *rabc* the side of a hill, either regular or irregular; and from the stations *R*, *A*, *B*, *C*, let a shot or shell be projected, with the same charge and elevation, striking the side of the ascent or hill in the points *r*, *a*, *b*, *c*, respectively. At the stations *A*, *B*, *C*, let the angles *rAa*, *rBb*, *rCc*, be observed with an instrument; and also at *a*, *b*, *c*, observe the angles *raB*, *rbB*, *rcC*, which with the distances *Ar*, *Br*, *Cr*, will determine the amplitudes *Aa*, *Ba*, *Ca*: parallel to which amplitudes draw through *R*, the lines *Rd*, *Re*, *Rf*, each equal to its parallel amplitude, which will determine the points *d*, *e*, *f*, in the curve. And in like manner may many other points be determined.

Plate XII. fig. 2. The angle of incidence *Rpt*, at which the shell strikes the ground, may be determined by erecting a small stage, *abcd*, through which the shell may pass at *P*, and strike the ground at *p*; for then the direction *Pp* will shew the angle of incidence *Rp*, *Pt*. In small elevations, a curtain might be placed near the extremities of the range *R*, *r*, which would determine *PA*, and *A*, *R*; and *pa*, and *ar*, and consequently the angle of incidence *arp*. The abscis *PA* would shew how far the ball deviated from the curve of the parabola described on the actual range *Rr*. See Pl. XII. fig. 3.

Pl. XII. fig. 4. By a singular method on a descent, the continuation of the curve below the horizon may be determined. The vertex *V* of the curve is always nearer to *r*, the extremity of the range, than to the beginning of it, *R*; that is, *RB* is greater than *Br*. The vertex *V* must be determined by two observers with theodolites (or rather with such an instrument as Mr. Robins measured the height of the ascent of rockets with) which will determine *VB*, *RB*, and *Br*.

The curve from the vertex *V* to the horizon *r*, will probably coincide very nearly with a parabola, as the horizontal velocity at the vertex is never very great.

Experiments tried by the Military Society *at Woolwich in 1765, for the purpose of obtaining the initial velocities of shot.*

These experiments were executed by a pendulum in imitation of Mr. Robins's, but greatly improved. The first was on the 13th day of May, 1775, it being a clear day; the weight of the pendulum = 328 lb. length from the axis to the ribbon = 102½ inches; from the axis to the centre of oscillation = 88 inches; from the axis to the centre of gravity = 72 inches. Distance of the pendulum from the muzzle of the gun = 29 feet. The powder was common government's powder, put into flannel cartridges, gently rammed home, and without wad.

Table *of Experiments, 13th May*, 1775.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of charge	Struck below the axis.	To the right or left	Chord of the arc	Velocity per second
	oz.	inch.	inch.	inch.	inch.	inch.	inch.	feet
1	2	17½	1.98	——	92.5	0.8 R	13	457
2	2	17½	1.98	——	92.5	0.8 R	17.75	625
3	2	17½	1.98	3.15	91.6	0	18.1	644
4	2	17¼	1.97	3.15	91	1.5 R	17.6	640
5	2	17¼	1.97	3.15	90.5	0.3 R	16.3	595
6	2	17	1.96	3.1	92.4	1.8 L	16.2	588
7	4	17	1.97	4.5	92	1 L	24	863
8	4	17	1.96	4.5	90.5	0.3 R	25	927

The penetrations were neglected, as very uncertain, on account of several shot striking so near the same place. The quantity of it seemed to be about 3 inches in solid wood. The great difference between the velocity of the first shot, and all the rest, must have been owing to some unperceived accident. The mean velocity among the rest is 618 feet in a second, with 2 oz. of powder: the mean weight of the balls is 17¼ inches nearly; which velocity is about 1-6th

1-6th part less than when the shot is 1-8th part heavier; owing, no doubt, to the windage attending the smaller shot. The mean between the two last with 4 oz. of powder is 895 feet, which also is proportionably less than when the shot is larger, so as to leave no windage. Moreover, these two velocities are nearly as 1. to 1.414, the square roots of the quantities of powder.

Experiment II. 3d June, 1775. A clear day, but windy; when every thing was the same as the former day.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of charge	Struck below the axis	To the right or left	Penetration	Chord of the arc	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	inches	feet
1	2	19½	2.08	2.85	88½	1½ R	—	24½	802
2	2	19½	2.08	2.85	89	0	6⅞	30½	1004
3	2	19½	2.08	2.85	93½	0	5⅜	30	940
4	2	19½	2.08	3.35	92½	0	5¼	57	755
5	2	19½	2.08	3.35	93	1 R	—	57	713
6	2	19½	2.08	3.3.	92	½ R	5½	53	731

The first 3 rounds, the shot had no windage, consequently the velocities much greater than those of the first day's experiments. The 3 last rounds were made with long shot, whose form may be termed hemispherical-cylindrical, as they were terminated by hemispherical ends; so that their section through the axis was of this form  and the length near double of its breadth.

The 4th shot, or the first of the long kind, struck the face of the pendulum sideways, making a hole of the shape of the above section, differing in this however, that its length or axis was not horizontal, but vertical thus  The 5th shot struck obliquely, neither exactly with its end or side foremost. Hence all long shot have an irregular rolling motion.

The penetrations were always measured to the hinder or outward end of the shot, as it lay in the wood.

Experiment III. 12th June, 1775; clear day and calm.

Rounds	Weight of powder	Weight of shot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Diameter of the shot	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	feet
1	2	19½	2.85	94	0.5 R	23	2,080	700
2	2	18¼	2.85	94	0.	24½	2.036	796
3	2	18½	2.85	93½	1.6 R	22	2.045	708
4	4	19	4	92¼	0	27¾	2.062	866
5	4	18¼	4	93½	1 L	35	2.036	1141
6	4	18½	4	93½	0	33	2,045	1062

The whole weight of the pendulum = 324 lb.
Length to the centre of gravity = 71.4 inches.
Length to the centre of oscillation = 88 inches.
Length from the axis to the ribbon = 102¼.
Distance of the gun 29 feet. Common-practice powder.

The mean weight of the first 3 shot is 18¾ ounces, and of the latter 3 shot 18½. Also the mean velocities, with 2 oz. and 4 oz. of powder, are 735 and 1023; which numbers are to each other as 1 to 1.4, that is, nearly as the square roots of the quantities of powder.

Experiment

Experiment IV. 20th July, 1775. A clear fine day.

Rounds	Weight of powder	Weight of shot	Diameter of shot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Values of p.	Values of g.	Velocity per second
	oz.	oz.	inches	inches	inches	inches	inches	lb.	inches	feet
1	2	$28\frac{1}{4}$	2.021	2.85	90	1 R	$14\frac{3}{4}$	552	78.0000	612
2	4	$28\frac{1}{4}$	2.021	4.4	87	$\frac{1}{2}$ L	$20\frac{1}{4}$	$553\frac{1}{4}$	78.0316	883
3	8	$28\frac{3}{4}$	2.032	7.1	87	$\frac{1}{2}$ L	$27\frac{1}{2}$	$555\frac{1}{2}$	78.0632	1168
4	2	$28\frac{1}{2}$	2.026	2.85	90	0	15	$557\frac{1}{4}$	78.0948	624
5	4	$28\frac{1}{2}$	2.026	4.4	88	1 L	$20\frac{1}{2}$	559	78.1 64	874
6	8	$28\frac{3}{4}$	2.032	7.1	92	$4\frac{1}{4}$ L	$28\frac{1}{2}$	$560\frac{3}{4}$	78.1580	1158
7	2	$28\frac{1}{4}$	2.021	2.85	$89\frac{3}{4}$	1 L	14.3	$562\frac{1}{2}$	78.1896	608
8	4	$28\frac{1}{2}$	2.026	4.4	$91\frac{1}{4}$	$1\frac{1}{2}$ L	21	$564\frac{1}{4}$	78.2212	874
9	8	$28\frac{1}{2}$	2.026	7.1	87	1 L	26.8	566	78.2528	1173

Weight of the pendulum = 552 lb. = p. Length to the centre of gravity = 78 inches = g. Length to the centre of oscillation = 88 inches = n. Length from the axis to the ribbon = 101 inches. Gun and powder the same; but the shot were of lead.

The velocities calculated in this course were corrected by the proper allowance for the increase of the weight of the pendulum, by so many heavy balls lodging in it, and which gave occasion for the 10th column, containing the several values of p, or the weight of the pendulum; the necessary allowance was also made for the alterations in the value of n, or place of the centre of oscillation, and in the centre of gravity, or value of g, as specified in the 11th column.

In the experiments of this day, the conclusions are very uniform and accurate; the mean velocity with 2 ounces of powder is 615 feet, with 4 ounces 877 feet, and with 8 ounces 1166 feet; which are to one another as the numbers 1, 1.426, and 1.9, that is, again, nearly as the square roots of the quantity of powder. The mean weight of the balls is $28\frac{1}{2}$ ounces nearly.

Experiment V. 21st Sept. 1775, between the hours of 2 and 6; it being a fine clear afternoon, rather windy, and the morning rainy.

Weight of the pendulum = 553 lb. = p. Length to the centre of gravity = 78.125 inches = g. Length from the axis to the ribbon = 101 inches; to the centre of oscillation = 84.775 inches = n. The number of vibrations were 68 in 100 seconds. Distance of the gun = 30 feet. Powder as before.

Rounds	Powder	Shot in oz.	and dr.	Weight of shot in lb.	Diameter of shot	Height of charge	Struck below axis	To the right or left	Cord of the arc	Values of p.	Values of g.	Velocity per second
	oz.	oz.	dr.	lb.	inches	inch.	inches	inches	inches	lb.	inches	feet
1	2	19	0	1.1875	2.062	3	88.25	0.3 L	11.35	553.00	78.125	700
2	4	19	0	1.1875	2.062	4.3	88.25	0.3 L	17.3	554.24	78.147	1070
3	8	19	0	1.1875	2.062	6.3	91.0	0	23.6	555.54	78.169	1419
4	2	19	$3\frac{1}{4}$	1.2012	2.070	3	90.65	1.5 R	11.35	556.80	78.196	679
5	4	19	$8\frac{1}{2}$	1.2208	2.081	4.3	90.65	1.5 R	17.3	558.10	78.223	1021
6	8	19	$0\frac{1}{4}$	1.1904	2.064	6.7	90.65	1.5 R	22.3	559.41	78.240	1353
7	2	18	15	1.1838	2.060	3	91	0.8 R	11.35	560.60	78.266	692
8	4	18	14	1.1797	2.058	4.3	90	0.	15.3	561.99	78.293	948
9	8	18	$9\frac{3}{4}$	1.1631	2.049	6.7	90	0	22.9	563.17	78.317	1443
10	2	18	9	1.1612	2.047	3	88.25	0.5 L	10.9	564.39	78.341	704
11	4	18	$4\frac{1}{4}$	1.1419	2.037	4.3	88.25	2.0 R	14.8	565.57	78.361	974
12	8	18	$3\frac{1}{4}$	1.1396	2.036	6.7	88.25	2.0 R	20.6	566.86	78.381	1358
13	2	18	3	1.1367	2.034	3	92	1.25 R	11.35	568.00	78.401	723
14	4	18	3	1.1367	2.034	4.3	92	1.0 L	15.0	569.14	78.428	958
15	8	18	$1\frac{1}{2}$	1.1367	2.031	6.7	94.3	0.5 L	22.5	570.29	78.455	1412

Q Corrections

Corrections of the variable quantities were made here very accurately, as in the last course. The weight of the wooden plugs, driven in to fill up the holes made by each shot, were also added to the pendulum.

The mean among all the velocities, with 2 ounces of powder, is 700; among those with 4 ounces, is 994; and among those with 8 ounces, is 1397: which are to one another as the 3 numbers 1, 1.42, and 2; that is, very nearly in the ratio of the square roots of the quantities of powder. Also the mean weight of the balls, is nearly 18⅔ ounces.

Moreover, by comparing the weight and velocities of the shot in this course, with those in the course next before, it is found that the velocities, with the same quantities of powder, are very near reciprocally as the square roots of the weights of the shot.

In the first place it may be observed, that the increase of velocity is very considerable by diminishing the windage, in so much that of shells or round shot, fired out of artillery, with the same quantity of powder, the larger shot has always a much greater velocity than the less one has; so that, by diminishing the windage, the momentum or force of the shot is much increased, as well by the increase of the velocity, as of the weight of the shot: and as it is the opinion of the founders of shot and cannon, that they can now work much truer than at the time when the present windage was first settled; it therefore seems, that the shot might (without any inconvenience) be so much increased, and the windage thereby decreased, that ½ or ⅔ of the present usual quantity may produce as great an effect as the whole does now: hence ½ or ⅓ of the powder may be saved.

That increasing the quantity of the charge does not increase the velocity, so much as at first sight might be expected, and the range still less; for a double charge gives but between ½ and 1-3d more velocity, and the range will be scarcely 1-4th or 1-5th more.

By comparing together the effects of shot of different weights, it appears, that by increasing or diminishing the weight of the shot (still retaining the same diameter) does not alter the velocity proportionally; but only in such proportion as the alteration just mentioned with regard to the quantity of powder; that is, a shot of double weight will move with a velocity but about 1-3d less than before; but its range will not be so much diminished, because its greater weight will better overcome the resistance of the air. Hence, leaden shot will range as far, or farther, than iron shot: and therefore, if a hard and cheap metal could be obtained, as heavy as lead, it would be a great improvement in artillery. But such improvement may also be effected by making hemispherical-cylindrical shot, as used in the second experiment, as it from thence appears, that by lengthening the shot, and rounding its ends, it may be increased to double or triple the weight, without losing any of the velocity, when the windage is sufficiently diminished. Shot of this kind would therefore be a very great improvement in artillery, for both land and sea service; for by this means, small and light cannon may be made to throw shot of twice, thrice, or four times the weight of their proper round shot; thus be made to answer the end of the very heaviest battering cannon; which will be a prodigious saving (besides that of the powder) in the value or casting of the guns, and making of the carriages, and likewise in the expence and trouble of conveying them with an army, or by sea. Besides, there is another advantage attending these shot for the sea service, which is, that they will do much more damage to ships, by rending and splintering them more than round shot can do, if these were even as heavy as the long ones. See PROJECTILES.

GUN-POWDER, a composition of saltpetre, sulphur, and charcoal, well mixed together and granulated, which easily takes fire, and expands with amazing force.

Invention of GUNPOWDER, is usually ascribed to one Bartholdus Schwartz, a German monk, who discovered it about the year 1320; and the first use of it in war is commonly supposed to have been by the Venetians against the Genoese in the year 1380. Thevel says its inventor was one Constantine Anelzen, a monk of Friburg. Peter Mexia says it was first used by Alphonsus XI. king of Castile, in the year 1342. Ducange adds, that there is mention made of this powder in the registers of the chambers of accounts of France, so early as the year 1338; and our countryman, Friar Bacon, expressly mentions the composition in his treatise *De nullitate Magiæ*, published at Oxford in the year 1216. Some indeed are of opinion that the Arabians, or the latter Greeks, were the first inventors of gunpowder, about the middle ages of our æra; because its Arabic name is said to be expressive of its explosive quality.

Method of making GUN-POWDER. Take saltpetre, sulphur, and charcoal; reduce these to a fine powder, and continue beating them for some time in a stone mortar, with a wooden pestle,

pestle, wetting the mixture between whiles with water, so as to form the whole into an uniform paste, which is afterwards reduced to grains, by passing it through a white sieve for the purpose; and in this form, being carefully dried, it becomes the common gun-powder. For greater quantities, mills are used, by means of which more work may be performed in one day, than a man can do in a hundred. See MILL.

How to refine salt-petre. Put into a copper, or any other vessel, 100 weight of rough nitre, with about 14 gallons of clean water, and let it boil gently for ½ an hour, and as it boils take off the scum; then stir it about in the copper, and before it settles put it into your filtering-bags, which must be hung on a rack, with glazed earthen pans under them, in which must be sticks laid across for the crystals to adhere to: it must stand in the pans for 2 or 3 days to shoot; then take out the crystals and let them dry. The water that remains in the pans, boil again for an hour, and strain it into the pans as before, and the salt-petre will be quite clear and transparent; if not, it wants more refining; to do which proceed as usual, 'till it is well cleansed of all its earthy parts.

How to pulverise salt-petre. Take a copper kettle, whose bottom must be spherical, and put into it 14 lb. of refined salt-petre, with 2 quarts or 5 pints of clean water; then put the kettle on a slow fire; and when the salt-petre is dissolved, if any impurities arise, skim them off, and keep constantly stirring it with 2 large spatulas, 'till all the water exhales; and when done enough, it will appear like white sand, and as fine as flour: but if it should boil too fast, take the kettle off the fire, and set it on some wet sand, which will prevent the nitre from sticking to the kettle. When you have pulverised a quantity of salt-petre, be careful to keep it in a dry place.

Different kinds of GUN-POWDER. It being proper that every one who makes use of powder, should know of what it is composed, &c. Gun-powder, for some time after the invention of artillery, was of a composition much weaker than what we now use, or than that ancient one mentioned by Marcus Græcus: but this, I presume, was owing to the weakness of their first pieces, rather than to their ignorance of a better mixture; for the first pieces of artillery were of a very clumsy, inconvenient make, being usually framed of several pieces of iron bars, fitted together lengthways, and then hooped together with iron rings; and as they were first employed in throwing stone shot of a prodigious weight, in imitation of the ancient machines, to which they succeeded; they were of an enormous bore. When Mahomet II. besieged Constantinople in the year 1453, he battered the walls with stone bullets, and his pieces were some of them of the calibre of 1200 lb.; but they could not be fired more than 4 times in the 24 hours, and sometimes they burst by the first discharge. Powder at first was not grained, but in the form of fine meal, such as it was reduced to by grinding the materials together; and it is doubtful, whether the first graining of it was intended to increase its strength, or only to render it more convenient for the filling it into small charges, and the loading of small-arms, to which alone it was applied for many years, whilst meal-powder was still made use of in cannon. But at last the additional strength which the grained powder was found to acquire from the free passage of the fire between the grains, occasioned the meal powder to be entirely laid aside. The coal for making gun-powder, is either that of willow or hazle; but the lightest kind of willow is found to be the best, well charred in the usual manner, and reduced to powder. Corned powder was in use in Germany as early as the year 1568; but first generally used in England in the reign of Charles I.

Government-Powder, } such powder as, hav-
Ordnance-Powder, } ing undergone the customary proof established by the board of ordnance, is received into the king's magazines.

Proof of GUN-POWDER, *as practised by the board of ordnance.* They first take out of the several barrels of gun-powder, a measure full, of about the size of a thimble, which is spread upon a sheet of fine writing-paper, and then fired: if the inflammation is exceeding rapid, the smoke rises perpendicular, and the paper is neither burnt nor spotted, it is judged to be good powder.

Then 2 drams of the same powder is exactly weighed, and put into an eprouvette; which, if it raises a weight of 24 pounds to the height of 3½ inches, it is received into the king's magazines.

GUN-POWDER *Prover.* See EPROUVETTE.

H

HABERGEON, in *military antiquity*, was a small coat of mail, or only sleeves and gorget of mail, formed of little iron rings, or mashes linked into each other. See GORGET.

HABILIMENTS *of war*, in our *ancient statutes*, signify armour, harness, utensils, or other provisions for war, without which there is supposed no ability to maintain a war.

HALBARD, HALBERT, in the *art of war*, a well-known weapon, carried by the serjeants of foot, and artillery. It is a sort of spear, the shaft of which is about 5 feet long, made of ash, or other wood. Its head is armed with a steel point, edged on both sides. Besides this sharp point, which is in a line with the shaft, there is a cross piece of iron, flat and turned down at one end, but not very sharp; so that it serves equally to cut down, or push withall. It is more for show than use.

The halbard is a very ancient weapon, being made use of by the Amazons, and afterwards by the Rhetians and Vindelicians about the year 570.

HALF-*Files*. See FILES.

HALF-*Moon*, or *demi-lune*. See FORTIFICATION.

HALT, is to discontinue the march of troops, to stand still, to stop in order to rest or perform any other motion; hence the word of command for troops to stop is, HALT.

HAIR-*Cloth*, used on the floor of powder magazines, and laboratories, to prevent accidents of fire from men's shoes treading or rubbing upon nails, sand, or gravel, and so striking fire.

HAND-*Barrow*, is made of light wood, and is of great use in fortification, for carrying earth from one place to another; or, in a siege, for carrying shells or shot along the trenches.

HAND-*Grenades*, are small iron shells from 2.5 to 3 inches diameter, filled with powder, which being lighted by means of a fuze, are thrown by the grenadiers amongst the enemy on sundry occasions.

HAND-*Screws*, are composed of a toothed iron bar, that has a claw at the lower end, and a fork at the upper: this bar is fixed in a stock of wood about 2.5 feet high, and 6 inches thick, moved by a rack-work; so that this claw or fork, being placed under a weight, raises it as far as the bar can go.

HAND-*Spikes*, in *gunnery*, are wooden levers 5 or 6 feet long, flattened at the lower end, and tapering towards the other; useful in moving guns to their places, after being fired and loaded again.

HAND-*Mallets*, are wooden hammers, with a handle, to drive fuzes and pickets, in making fascine or gabion batteries, &c.

HASP, a flat staple to catch the bolt of a lock. See CARRIAGE.

HATCHET, used in the army, a small light sort of an ax, with a bazil edge on the left side, and a short handle; used by the men for cutting wood to make fascines, gabions, pickets, &c.

HAVERSACK, in a *military sense*, is a kind of bag, made of strong coarse grey linen, to carry bread and provisions on a march. They are only used in the field, and in cantonments, each soldier having one.

HEAD, in *gunnery*, the fore part of the cheeks of a gun or howitz carriage.

HEAD *of a work*, in *fortification*, is the front next to the enemy, and farthest from the place; as the front of a horn-work is the distance between the flanked angles of the demi-bastions: the head of a double tenaille is the salient angle in the centre, and the two other sides which form the re-entering angles. See FORT.

HEAD *of an army*, is the front, whether drawn up in lines, or on a march.

HEAD *of a double tenaille*, the salient angle in the centre, and the two other sides which form the re-entering angle.

HEAD-*Piece*, armour for the head, an helmet, such as the light dragoons wear.

HEAD *of a camp*, the ground before which the army is drawn up.

HELEPOLIS, in the *ancient art of war*, a machine for battering down the walls of a place besieged: the invention of it is ascribed to Demetrius the Poliorcete. Diodorus Siculus says, that each side of the *helepolis* was 450 cubits broad, and 90 in height; that it had 9 stages, and was carried on 4 strong solid wheels, 8 cubits in diameter; that it was armed with huge battering-rams, and had 2 roofs capable of supporting them; that in the lower

lower ſtages there were different ſorts of engines for caſting ſtones; and in the middle they had large catapultas for lancing arrows, with a number of expert men for working all theſe machines.

HELMET, an ancient defenſive armour, worn by the horſemen, both in war and tournaments. It covered both the head and face, only leaving an aperture in the front, ſecured by bars, which was called the viſor. The Carians firſt invented the boſs of ſhields and the creſt of helmets. In remembrance of this, a ſmall ſhield and a creſt were always buried with them. It is now entirely in diſuſe.

HELVES, or *Hafts*, the wooden handles of hatchets, hammers, or pick-axes, &c.

HEMERODROMI, in the *ancient art of war*, were a kind of centinels or guards appointed for the ſecurity and preſervation of cities and other places.

HENDECAGON, a figure that has 11 ſides, and as many angles, each capable of a regular baſtion.

HEPTAGON, a figure conſiſting of 7 ſides, and as many angles. If the ſides be all equal, it is called a regular *heptagon*, &c.

HEPTAGONAL *numbers*, are a ſort of polygonal numbers, wherein the difference of the terms of the correſponding arithmetical progreſſion is $= 5$. One of the properties of theſe numbers is, that if they be multiplied by 40, and 9 be added to the product, the ſum is a ſquare number.

HERALD, an officer at arms, whoſe buſineſs it is to declare war, to proclaim peace, to marſhal all the ſolemnities at the coronation, chriſtening, marriage, and funeral, of princes and great generals.

HERRISON, in *fortification*, a beam or barrier made of one ſtrong piece of wood, full of iron ſpikes. It is generally ſupported in the middle, and turns upon a pivot or axis. Its uſe is to ſtop up any paſſage, though frequently placed before the gates, and more eſpecially the wicket-doors of a town or fortreſs; to ſecure thoſe paſſages, which muſt of neceſſity be often opened and ſhut.

HERO, in a *military ſenſe*, is a great, illuſtrious, and extraordinary perſonage; particularly in reſpect of valour, courage, intrepidity, and other military virtues. Modern authors make a diſtinction between a hero, and a great man; that the former is more daring, fierce, and enterpriſing; and the latter more prudent, thoughtful, and reſerved. In this ſenſe we ſay, Alexander was a hero, and Julius Cæſar a great man.

HERSE, in *fortification*, ſtrong pieces of wood jointed croſs-ways, like a lattice or harrow, and ſtuck full of iron ſpikes. It is uſually hung by a rope, faſtened to a molinet, which is cut in caſe of a ſurpriſe, or when the firſt gate is forced by ſurpriſe, or with a petard, to the end that it may fall and ſtop the paſſage of the gate, or other entrance of a fortreſs.

Theſe *herſes* are alſo often laid in the roads, with the points upwards, inſtead of the chevaux-de-frize, to incommode the march of both horſe and foot. Common harrows are ſometimes made uſe of in caſe of haſte, and turned with their points upwards.

HERSILLON, in the *military art*, is for the ſame uſe as the herſe, and is made of one ſtrong beam, about 10 or 12 feet long, whoſe two ſides are ſtuck full of ſpikes, to incommode both horſe and foot. The word is a diminutive of the preceding.

HEXŒDRON, one of the platonic, or 5 regular bodies, being a ſolid conſiſting of 6 equal ſides or faces, popularly called a cube.

HEXAGON, is a figure of 6 ſides, and as many angles, capable of being fortified with 6 baſtions. If the ſides and angles be equal, it is called a regular hexagon. The ſide of a regular hexagon inſcribed in a circle, is equal to the radius of that circle; hence a regular hexagon is inſcribed in a circle, by ſetting the radius of 6 times upon the periphery: as 1 to 1.672, ſo is the ſquare of the ſide of any regular hexagon to the area thereof nearly.

Tanned HIDES, are always carried along with an army, eſpecially in the laboratory's ſtores, to protect powder or ſhells from rain: they are alſo uſed upon batteries, and in laboratories.

HINGES, are two iron bands, with a joint nailed to the doors or lockers of gun-carriages to faſten them, and move them backwards and forwards.

HISTORY, a narration or deſcription of the ſeveral tranſactions, actions, or events of a ſtate, king, or private perſon, in the order in which they happened.

Military HISTORY, a faithful narrative of military tranſactions, campaigns, battles, ſieges, marches, &c. of an army: likewiſe a relation of the heroic actions of great generals, &c.

HOBITS. See HOWITZ.

HOLLOW-*Square*, a body of foot drawn up with an empty ſpace in the middle, for the colours, drums, and baggage, &c. See SQUARE.

HOLLOW-*Tower*, is a rounding made of the remainder of 2 briſures, to join the curtain to the orillon, where the ſmall ſhot are played, that

that they may not be so much exposed to the view of the enemy.

Order of the HOLY-GHOST, the principal military order in France, instituted by Henry III. in 1569. It consists of 100 knights, who are to make proof of their nobility for three descents. The king is the grand master, or sovereign, and as such, takes an oath, on his coronation-day, to maintain the dignity of the order. The knights wear a golden cross, hung about their necks by a blue silk ribband, or collar: but before they receive this order of the Holy-Ghost, that of St. Michael is conferred, as a necessary degree; and for this reason their arms are surrounded with a double collar.

HONEY-*Combs*, in *cannon*, flaws in the metal, a fault in casting, and dangerous in firing. The board of ordnance rejects all guns (on proof) having an honey-comb of $\frac{1}{10}$ of an inch deep, as being unfit for service.

HONOUR, in a *military sense*, is a vague expression, to which custom has given different meanings. Honour consists in the constant practice of virtue. Aristotle calls it the recompence of virtue; the testimony of the excellence of a man who distinguishes himself by virtue. An Italian writer calls it a state of inviolable dignity, above all calumny, and all suspicion. Honour gives many advantages; it procures us the consideration of the public; it gives weight to our actions; it advances our fortunes. The best recompence of a brave action is, undoubtedly, the satisfaction of having done it; but nevertheless the honour resulting to us from it is a real good, which should be dear to us.

Military HONOURS. All armies salute crowned heads in the most respectful manner, drums beating a march, colours and standards dropping, and officers saluting. Their guards pay no compliment, except to the princes of the blood; and even that by courtesy, in the absence of the crowned head.

To the commander in chief the whole line turns out without arms, and the camp-guards beat a march, and salute.

To generals of horse or foot, beat a march and salute.

Lieutenant-generals of ditto, three ruffs, and salute.

Major-generals of ditto, two ruffs, and salute.

Brigadiers of ditto, rested arms, one ruff, and salute.

Colonels of ditto, rested arms, and no beating. Centinels rest their arms to all field-officers, and shoulder to every officer.

All governors, that are not general-officers, shall, in all places where they are governors, have one ruff, with rested arms; but for those who have no commission as governors, no drum shall beat.

Lieutenant-governors shall have the main-guard turned out to them with shouldered arms.

Prussian HONOURS *of war*, chiefly imitated by most powers in Europe, are,

To the king all guards beat the march, and all officers salute.

Field-marshals received with the march, and saluted in the king's absence.

Generals of horse or foot, four ruffs; but if he commands in chief, a march and salute.

Lieutenant-generals of horse or foot, (commanding or not) guards beat three ruffs.

Major-generals of horse or foot, two ruffs.

Officers, when their guards are under arms, and a general makes a signal, must rest to him, but not beat; when not got under arms, and a signal made, only stand by their arms.

Village-guards go under arms only to the king, field-marshals, generals of horse and foot, and to the general of the day.

Generals guards go under arms only to the king, field-marshals, and the general over whom they mount.

Commanding officers of regiments, and battalions, their own quarter and rear guards to turn out; but not to other field-officers, unless they are of the day.

Generals in foreign service, the same.

HONOURS *paid by centinels.*

Field-marshals, two centinels with ordered firelocks, at their tent or quarters.

Generals of horse or foot, two centinels, one with his firelock shouldered, the other ordered.

Lieutenant-generals, one, with firelock ordered.

Major-generals, one, with firelock shouldered.

The first battalion of guards go under arms to the king only; not to stand by, nor draw up in the rear of their arms to any other; nor to give centinels to foreigners. Second and third battalions draw up behind their arms to the princes, and to field-marshals; but when on grenadier-guards, or out-posts, they turn out, as other guards do, to the officers of the day. They give one centinel with shouldered arms to the princes of the blood, and to field-marshals, when they lie alone in garrison.

Guards on HONOUR *in Prussia.*

The king, what he pleases.

Field-marſhal and commander in chief, 1 lieutenant, 2 non-commiſſioned officers, and 40 men, to guard his baggage, &c. If the king is preſent, but 1 lieutenant, 1 non-commiſſioned officer, and 20 men.

General of foot, 1 enſign, 1 non-commiſſioned officer, and 15 men; but when he commands a detachment, 1 lieutenant, and 30 men.

Lieutenant-general, 1 non-commiſſioned officer, and 15 men. Ditto on detachments, 1 enſign, and 20 men.

Major-general, 1 non-commiſſioned officer, and 12 men.

Grand-magazine-guard depends on the greater or leſs quantity of proviſions.

Surgeon's cheſt, and ſolicitor-general's, remain in the neareſt covered town.

Provoſt-general's guard depends on the number of his priſoners.

Artillery provide their own guard.

Lieutenant and major-general's guard, from their brigades.

Field-marſhals and generals of foot, by their own regiments.

Generals guards formed by the eldeſt adjutants, after the quarter-guards are mounted, &c.

Generals guards to have pickets on the right of their tents.

Honours *paid to the King, &c. by garriſons in Pruſſia.*

When they permit, to fire a triple diſcharge of all the cannon, half-loaded.

Field-marſhal, ſingle diſcharge of 9 cannon, with half-loading; guards to beat a march, and officers ſalute.

Guards pay the ſame compliments to general officers in garriſon as in camp.

Colonel, when commandant; all guards reſt their arms, and port-guards ſhoulder their arms. Other guards reſt. Centinels reſt their arms to all field-officers.

Honours *by* Guards, *as a compliment to general officers, &c. with the detail of officers and men they are entitled to in the Engliſh army.*

Guards	Captains	Lieutenants	Enſigns	Serjeants	Drummers	Fifers	Private men
The general in chief has - -	1	1	1	2	2	2	50
General of horſe and foot - -	1	1	1	2	2	2	50
Lieut. gen. of horſe and foot -	—	1	—	1	1	1	30
Major-general of horſe and foot -	—	—	1	1	1	1	20
Brigadier - - - - -	—	—	—	1	—	—	12
Quarter-maſter-general - -	—	—	—	1	—	—	12
Majors of brigade, incamped together - - -	—	—	—	1	—	—	2
Judge advocate - - -	—	—	—	1	—	—	7
Provoſt-marſhal - -	—	—	—	1	—	—	18
Provoſt-marſhal, when he has priſoners - -	—	1	—	2	1	1	48

HOOKS, thoſe which are fixed to the tranſom plates of a field-carriage: they ſerve to fix the drag-ropes for drawing it occaſionally backwards and forwards.

HOOPS, of iron, of ſeveral ſorts, ſuch as nave and axle-tree hoops.

HORIZONTAL *Superficies*, is the plain field lying upon a level, without any riſing or falling.

Horizontal *Range.* See Range.

HORN-*Work.* See Fortification.

HORSE-*Shoe.* See Fortification.

HORSE, in a *military ſenſe.* / *A body of* Horse. - - } See Cavalry.

HOSPITAL, a place appointed for the ſick and wounded men, provided with a number of phyſicians, ſurgeons, nurſes, ſervants, medicines, beds, &c.

Camp-Hospitals, are either general or regimental. The general hospitals are of two kinds, viz.

Flying-Hospital. } The first attends the *Stationary*-Hospital. } camp at some convenient distance, and the latter is fixed at one place. In the choice of both Dr. Pringle thinks it better to have them in towns than villages, as the former will afford larger wards, besides more of other conveniences. These wards should be as airy as possible.

Regimental-Hospitals, are frequently in barns, stables, granaries, and other out-houses; but above all, churches make the best hospitals from the beginning of June to October: these hospitals are solely for the use of the regiment they belong to.

Hospital-*Fever*, a name given to the malignant catarrhal fever, as being most frequent in hospitals.

HOSTAGE, a person given up to an enemy as a security for the performance of the articles of a treaty.

HOSTILITY, denotes a state of war or enmity between two nations. During a truce all acts of hostility are to cease on both sides.

HOUSING, or saddle-housing, cloth, skin, or other ornament added to saddles, by way of distinction; frequently embroidered with gold or silver, or edged with gold or silver lace.

HOWITZ, a kind of mortar, mounted upon a field-carriage like a gun: the difference between a mortar and a howitz is, that the trunnions of the first are at the end, and in the middle in the last. The invention of howitzes is of much later date than mortars, for they really had their origin from them.

The constructions of howitzes are as various and uncertain as those of mortars, excepting the chambers, which are all cylindric. They are distinguished by the diameter of the bore; for instance, a 10-inch howitz is that, the diameter of which is 10 inches; and so of the smaller ones.

Dimensions of Howitzes. Plate XIII. fig. 6.

	Inch.	Inch.
Diameter of the bore —	10.	8.
From the muzzle to the reinforce	19.4	16.
Length of the reinforce —	11.9	10.7
Total length of the howitz	50.4	37.4
Length of the bore	29.2	25.9
Length of the chamber	16.8	9.9
Its greatest diameter	6.5	4.6
Its least diameter	5.6	4.
Breadth of the muzzle-ring	1.7	1.25
From the muzzle-ring to the astragal	4.3	4.6
Breadth of the astragal —	1.3	.7
Of the ogee before the reinforce	2.	1.4
Of the ogee behind the reinforce	1.7	0
Of the astragal — —	1.4	.7
Of the base ring — —	1.8	1.25
From the base-ring to the astragal	2.2	0
Breadth of the astragal	1.3	0
Thickness of the metal at the muz.	2.75	2.25
At the muzzle-ring —	5.	3.4
Near the reinforce —	3.4	2.6
At the reinforce —	5.0	3.4
Behind the reinforce —	4.4	2.5
Diameter of the base ring	20.	14.7
Diameter of the vent astragal	17.5	12.5
Diameter of the cascable	8.25	7.6
Diameter of the button	7.	3.
Diameter of the neck	5.	3.5
Breadth of the ogee and fillets	1.	.9
Of the second ogee and fillets	1.6	.9
Diameter of the first fillet	11.13	9.5
Diameter of the second	7.64	4.5
Length and diameter of the trunnion	6.	4.4
From the reinforce to the trunnion	2.	1.2
Chamber contains powder	lb. 18	lb. 4
Weight of the howitz	C. 31 2 26	12 1 11

Howitz-*Carriage*. See Carriage.

HUNTERS. See Horse.

HURDLES, in *fortification*, are made of twigs of willows or osiers, interwoven close together, sustained by long stakes. They are made in the figure of a long square; the length being 5 or 6 feet, and breadth 3 or 3½. The closer they are wattled together, the better. They serve to render batteries firm, or to consolidate the passage over muddy ditches; or to cover traverses and lodgements for the defence of the workmen against the fire-works, or the stones, that may be thrown against them.

HURTERS, a flatted iron fixed against the body of an axle-tree, with straps to take off the friction of the naves of wheels against the body.

Hurter. See Battery.

HUSSARS, are the national cavalry of Hungary and Croatia. Their regimentals consist in a rough furred cap, adorned with a cock's feather (the officers, either an eagle's or a heron's), a doublet, with a pair of breeches, to which the stockings are fastened, and yellow or red boots; besides they occasionally wear a short upper waistcoat, edged with furs, and 5 rows of round metal buttons, and in bad weather a cloak. Their arms are, a sabre, carbine, and pistols. They are irregular troops: hence, before

before beginning an attack, they lay themselves so flat on the necks of their horses, that it is hardly possible to discover their force; but being come within pistol-shot of the enemy, they raise themselves with such surprising quickness, and begin the fight with such vivacity on every side, that unless the enemy is accustomed to their method of engaging, it is very difficult for troops to preserve their order. When a retreat is necessary, their horses have so much fire, and are so indefatigable, their equipage so light, and themselves such excellent horsemen, that no other cavalry can pretend to follow them: they leap over ditches, and swim over rivers, with surprising facility. They never incamp, consequently are not burthened with any kind of camp-equipage, saving a kettle and a hatchet to every 6 men. They always lie in the woods, out-houses, or villages, in the front of the army. The Emperor, queen of Hungary, and the king of Prussia, have the most troops under this name in their service.

J I

JACK. See GIN.

JAMES, or *Knights of St. James*, a military order in Spain, first instituted in the year 1170, by Ferdinand II. king of Leon and Galicia. The greatest dignity belonging to this order is grand-master, which has been united to the crown of Spain. The knights are obliged to make proof of their descent from families that have been noble for 4 generations, on both sides: they must also make it appear that their said ancestors have neither been Jews, Saracens, nor heretics; nor have ever been called in question by the Inquisition. The novices are obliged to serve 6 months in the galleys, and to live a month in a monastery. They observe the rules of St. Austin, making no vows but of poverty, obedience, and conjugal fidelity.

JANIZARIES, an order of the Turkish infantry, reputed the Grand Signior's guards, and the main strength of the Ottoman army: they are all infantry, and were first formed of captive Christians by the emperor Amurath I. Their number is generally above 40,000, divided into 162 companies, or chambers, called *odas*, in which they live together at Constantinople, as in a convent. The Janizaries are of a superior rank to all other soldiers: they are also more arrogant and factious; and it is by them the public tranquillity is mostly disturbed. The government may therefore be said to be entirely in the hands of Janizaries. They have however some good qualities: they are employed to escort travellers, and especially ambassadors, and persons of high rank, on the road; in which case they behave with the utmost zeal and fidelity.

JAVELIN, in *military antiquity*, a sort of spear 5½ feet long; the shaft of which was of wood, with a steel point. Every soldier in the Roman armies had 7 of these, which were very light and slender.

ICHNOGRAPHY, in *fortification*, denotes the plan or representation of the length and breadth of a fortification, the distinct parts of which are marked out, either on the ground itself, or on paper: by this we are at once acquainted with the value of the different lines and angles.

IMPETUS, in *mechanics*, the force with which one body impels or strikes another. See GUNNERY, MOMENTUM.

INCH, a well-known measure in length, being the 12th part of a foot, and equal to 3 barley-corns in length. See MEASURE.

INCLINED *Plane*. See GUNNERY.

INCAMPMENT, the lodging of an army in the field, according to its several quarters, which are to lie conveniently for water, wood, and forage, &c. See CAMP.

INCAMP. *To incamp*, is the pitching of tents, when the army after a march is arrived at a place where it is designed to halt a night, or longer. See CAMP.

INDENTED *Line*, in *fortification*, is a line running out and in, like the teeth of a saw, forming several angles; so that one side defends another. They are used on the banks of rivers, where they enter a town; likewise the parapet of the covert-way is often indented. This is by the French engineers called *Redans*. Small places are sometimes fortified with such a line; but the fault of such fortifications is, that the besiegers from one battery may ruin both sides of the tenaille of the front of a place, and make

an assault; without fear of being enfiladed, since the defences are ruined.

INDEPENDENT *Company*, } is what is not
INDEPENDENT *Troop*, } incorporated into any regiment.

INFANTRY, means the whole body of foot soldiers, whether independent companies, or regiments. The origin of the word is taken from one of the Infantas of Spain, who, finding that the army commanded by the king her father, had been defeated by the Moors, assembled a body of foot soldiers, and with them engaged and totally routed the enemy. In honour of this event, and to distinguish the foot soldiers, who were not before held in much consideration, they received the name of infantry.

Heavy-armed INFANTRY, amongst *the ancients*, were such as wore a complete suit of armour, and engaged with broad shields and long spears. They were the flower and strength of the Grecian armies, and had the highest rank of military honour.

Light-armed INFANTRY, amongst *the ancients*, were designed for skirmishes, and for fighting at a distance. Their weapons were arrows, darts, or slings.

Light-INFANTRY have only been in use since the year 1656. They have no camp-equipage to carry, and their arms and accoutrements are much lighter than the infantry. Among the troops of this country is not found any light infantry, though they are the eyes of a general, and the givers of sleep and safety to an army. Wherever there is found light-cavalry, there should be light-infantry. They should be accustomed to the pace of 4 miles an hour, as their usual marching pace, and to be able to march at 5 miles an hour, upon all particular occasions. Most of the powers on the continent have light-infantry.

INFIRMARY. See HOSPITAL.

INGINEER. See ENGINEER.

INSCONSED, in the *military art*. Part of an army that have fortified themselves with a sconce or small work, in order to defend some pass, &c. are said to be *insconsed*.

INSULT, in the *art of war*. See ASSAULT.

INTERIOR *side of a fortification*, is an imaginary line drawn from the centre of one bastion to that of the next; or rather the curtain produced to the centres of the bastions.

INTERVALS, in the *art of war*, the spaces left between each regiment in camp, as likewise between each tent. See CAMP.

Intervals, though they never exceed the length of a battalion or squadron, are sometimes less, according to the views of a commander; so that there is no general rule in forming them.

INTRENCHMENT, any work that fortifies a post against an enemy that attacks. It is generally taken for a ditch or trench with a parapet. *Intrenchments* are sometimes made of fascines, with earth thrown over them, of gabions, hogsheads, or bags filled with earth, to cover the men from the enemy's fire. See RETRENCHMENT.

INVALID, is a soldier who has spent his time in war, and the army; and is, either through age, or by reason of his wounds, rendered incapable of the service. We have 20 independent companies of invalids, dispersed in the several forts and garrisons; and those that are incapable of any service, are disposed of in hospitals.

INVASION, in *war*, the entrance or attack of an enemy on the dominions of another.

JOINT-*Bolts*. See BOLTS.

IRON-*Guns*. See GUNS.

IRON, for marking with a broad R the horses that are taken for the government's service to draw the artillery, ammunition, and stores, &c.

IRONS. See PRIMING-IRONS.

INVESTING *a place*, is when a general, having an intention to besiege it, detaches a body of horse to possess all the avenues; blocking up the garrison, and preventing relief from getting into the place, 'till the army and artillery are got up to form the siege.

JUST, a sportive combat on horseback, man against man, armed with lances.

K

KEEP, in *ancient military history*, a kind of strong tower in the middle of a castle or fort, wherein the besieged made their last efforts of defence.

KETTLE, to boil composition for fireworks.

KETTLE-*Drums*. See DRUMS.

KETTLE-*Drum-Cart*, belonging to the royal artillery

artillery only, is a four-wheel carriage, drawn by 4 horses. On the fore part stands the ordnance-flag, and on the hind sits the drum-major, with 2 kettle-drums, as in a chair of state. This cart is finely engraven and gilt. It has not been in the field since the year 1743, when his majesty was present. It is kept in the tower.

KEYS, in *artillery carriages*, are of different sorts:

Fore-lock-KEYS, serve to pass through the lower end of bolts, to fasten them.

Spring-KEYS, serve the same purposes as the other; but, instead of being of one single piece, they are of two, like two springs laid one over the other: when they are put into eye-bolts, they are pinched together at the ends, and when they are in, open again: hence they cannot shake out by the motion of the carriages. They are used in travelling-carriages.

KEYS, with chains and staples fixed on the side-pieces of a carriage or mortar-bed: they serve to fasten the cap-squares, by passing through the eyes of the eye-bolts.

KLINKETS, in *fortification*, are a sort of small gates made through pallisades, for sallies.

KNAPSACK, in a *military sense*, a rough leather-bag, which a soldier carries on his back, and which contains all his necessaries. Square knapsacks are most convenient, and should be made with a division to hold the shoes, black-ball and brushes, separate from the linen. White goat-skins are the best.

KNIGHT, a person who, on account of some martial feat, or notable action, is by the king raised to a rank above a gentleman. The original German and Dutch word *knecht*, or *knebt*, signifies a servant, as we find it still meant by the knight of the shire; and afterwards it denoted a military man, or rather horseman, as being usually employed on horseback. In our common law they are called *milites*, as commonly holding lands by knights service, to serve the king in his wars.

L

LABARUM, in the *ancient art of war*, the standard born before the Roman emperors; being a rich purple streamer, supported by a spear.

LABORATORY, signifies that place where all sorts of fire-works are prepared, both for actual service, and for pleasure, viz. quick-matches, fuzes, portfires, grape-shot, case-shot, carcasses, hand-grenades, cartridges, shells filled, and fuzes fixed, wads, &c. &c.

Aigrettes. See MORTARS.

Balls are of various sorts, shapes and forms; as

Chain-shot, in *military matters*, are two shot linked together by a strong chain of 8 or 10 inches long: they are more used on board men of war, than in the land service. The famous M. de Witt was the first inventor, about the year 1665.

Light-balls, of which there are several sorts: the best composition is mealed powder 2, sulphur 1, rosin 1, turpentine 2½, and saltpetre 1½. Then take tow, and mix and dip it in this composition, 'till of a proper size, letting the last coat be of mealed powder. Or take thick strong paper, and make a shell the size of the mortar you intend to throw it out of, and fill it with a composition of an equal quantity of sulphur, pitch, rosin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a considerable time.

When they are intended to set fire to magazines, &c. make them as follows, viz. *Pl. XIV. fig. 9.* Set off with a radius of ¼ the calibre of the mortar, the circle *A B C D*, dividing the same into 4 equal parts: out of *B*, and with the radius *A B*, describe the arc *A E*; and from *A*, with the radius *A B*, describe the arc *B E*; and from *E*, with the radius *E A*, the arc *A B*: now 8 such pieces, as *A B E*, cut out of dimitty, &c. and sewed together, will make, when filled, a ball exactly round. N. B. A small hole must be left to fill them by. The composition for filling them is, mealed powder 10, saltpetre 2, sulphur 4, and rosin 1; or mealed powder 4, pounded glass 1, antimony ½, camphire ½, sal-ammoniac 1, common salt ¼; or mealed powder 48, saltpetre 32, sulphur 16, rosin 4, steel or iron filings 2, fir-tree saw-dust boiled in saltpetre leye 2, and birch-wood charcoal 1. With any of these compositions fill the sack, and ram it, if possible, as hard as a stone,

putting in the opening a fuze, and about the fame an iron ring 1-5th of the ball's diameter wide, and on the oppofite end, another ring 1-6th of the ball's diameter; then with a ftrong cord of 1-4th of an inch diameter, lace round the hoops, or rings, from one end of the ball to the other, as often as requifite; this is called the ribbed-coat: then lace it again the contrary way, which is called the check-coat.

Between each fquare cord, iron barrels are drove in, 1-3d of which are filled with powder, and a bullet: at the end of each a fmall vent is made, that the compofition may inflame the powder, and drive the balls out on every fide, which not only kill numbers of people, but prevent any one from extinguifhing the fire-ball. The whole muft, when finifhed, be dipped in melted pitch, rofin, and turpentine oil; which faftens the whole together.

Smoke-balls, are made and contrived to give an uncommon fmoke, and thereby prevent the enemy from feeing what you are about. They are prepared as above, only the compofition muft be 5 to 1 of pitch, rofin, and faw-duft: the ingredients are put into iron fhells, having 4 holes each to let out the fmoke, and are thrown out of mortars.

Experiments with Smoke-Balls, *in iron-fhells,* 1762.

Nature of Mort.	Shells wt. emp.	Shells wt. full	powder		eleva-		Len. of pr. fuze	Len. of pr. p.fire	time of fmoke		range	Remarks.
	lb.	lb.	lb.	oz.	°	'	inch.	inch.	'	"	feet	
13	183	203	2	12	45		1½	1½	27		1668	They all gave a good fmoke in general.
13	187	200½	2	10	45		1½	1½	26	30	1678	
13	185	216	2	8	40		1½	1½	23	15	1438	
13	190	208	1	2	40	30	1½	1½	24		976	
10	78	97	1	4	45		1½	1½	26		1350	
10	76	98	1	5	45		1½	1½	30		1396	
10	80	93	1	6	45		1½	1½	28	30	1399	
10	79	96½	1	7	36	30	1½	1½	36		1413	

N. B. *The Powder was in flannel cartridges.*

Stink-
Poifoned-
Red-hot-
Chain-
Stang-
Anchor-
} *Balls.* See Balls.

Meffage-Balls. See Shells.

Fire-Barrels, are at prefent not much ufed: they were of different forts; fome mounted on two wheels. The infide of the barrel is loaded with powder, and the outfide full of fharp iron points, intermixed with grenades loaded, and fuzes fixed. Sometimes they are placed under ground, and made ufe of to annoy the enemy's approach.

Carcafs, in *military affairs*, was formerly of an oval form, made of iron bars, and filled with a compofition of mealed-powder, faltpetre, fulphur, broken glafs, fhavings of horn, pitch, turpentine, tallow, and linfeed-oil, covered with a pitched cloth: it is primed with mealed powder and quick-match, and fired out of a mortar. Its defign is to fet houfes on fire, &c. See Carcass at letter C.

Experiments with ROUND CARCASSES *at an elevation of* 45°.

Mortars	Weight of the carcass		Quantity of powder		Flight	Time of burning		Length of priming	Range	Remarks
	lb.	oz.	lb.	oz.	″	′	″	inch.	feet	
10	62	13		8	6	3		$2\frac{7}{10}$	390	Burnt well in general. Fired from 7 to 9, in the morning. Good light.
0	64	12		12	8	3	12	$2\frac{7}{10}$	774	
10	70		1		10	3	40	$2\frac{7}{10}$	882	
10	71	12	1	4	11½	4		$2\frac{7}{10}$	1332	Fired from 2 to 4 in the morning, very dark. Gave a very good light.
10	72		1	12	13	4	18	$2\frac{7}{10}$	1815	
10	68	10	2		14	4	45	$2\frac{7}{10}$	2043	
8	33	7		6	6	3	4	$2\frac{7}{10}$	411	Fired from 10 to 2 in the night. Had a very good effect.
8	36	12		10	8	3	20	$2\frac{7}{10}$	963	
8	35	8		14	12	5		$2\frac{7}{10}$	1344	
8	34	14	1		14	3	40	$2\frac{7}{10}$	1680	
8	32	12	1	4	13	5	10	$2\frac{7}{10}$	1908	

None but *round carcasses* are used at present, the flight of the oblong ones are so uncertain. The composition is, pitch 2, saltpetre 4, sulphur 1, and corned powder 3. When the pitch is melted, the pot is taken off, and the ingredients (well mixed) put in; then the carcass is filled with as much as can be pressed in.

Experiments with 13-*inch round* IRON CARCASSES, *with* 4 *holes; fired out of a* 13-*inch sea-service mortar, at Woolwich, in* 1773.

Empty			Full			Powder		Elevation		Range	Remarks
c.	qr.	lb.	c.	qr.	lb.	lb.	oz.	deg.	m.	feet	
1	2	27	1	3	12	30		45		8700	One small piece burst from the carcass, and fell at 4500 feet distance; the other piece contained the composition. The two last did not break.
1	3	1	1	3	14	30		41		9000	
1	3	3	1	3	16	30		42		10200	
1	1	4	1	3	17	30		42	30	10500	

Cartridges, in *military matters*, are made of various substances, such as paper, parchment, bladders, and flannel. When they are made of paper, the bottoms remain in the piece, and accumulate so much, that the priming cannot reach the powder; besides other inconveniences. When they are made of parchment or bladders, the fire shrivels them up, so that they enter into the vent, and become so hard, that the priming-iron cannot remove them so as to clear the vent. Nothing has been found hitherto to answer better than flannel, which is the only

thing

thing used at present for artillery cartridges of all sorts, because it does not keep fire, and is therefore not liable to accidents in the loading; but, as the dust of powder passes through them, a parchment cover is sometimes made to put over them, which is taken off when used.

The best way of making flannel cartridges, is to boil the flannel in size; which will prevent the dust of powder from passing through them, and render them stiff, and more manageable; for without this precaution they are so pliable, when large, and contain much powder, that they are put into the piece with much difficulty.

The loading and firing guns with cartridges is done much sooner, and less liable to accidents, than with loose powder.

In quick firing the shot is fixed to the cartridge by means of a wooden bottom, hollowed on one side so as to receive nearly half the shot, which is fastened to it by 2 small slips of tin crossing over the shot, and nailed to the bottom; and the cartridge is tied to the other end thereof. They are fixed likewise in the same manner to the bottoms of grape-shot, which are used in field-pieces.

Fuzes, in *artillery*, are chiefly made of very dry beech-wood, and sometimes of horn-beam, taken near the root. They are turned rough, and bored at first, and then kept for several years in a dry place: the diameter of the hole is about 1-4th of an inch: the hole does not go quite through, leaving about 1-4th of an inch at the bottom; and the head is made hollow in the form of a bowl.

The composition for fuzes is saltpetre 3, sulphur 1, and mealed powder, 3, 4, and sometimes 5. This composition is drove in with an iron driver, whose ends are capped with copper to prevent the composition from taking fire; and equally hard as possible; the last shovelfull being all mealed powder, and two stands of quickmatch laid across each other, being drove in with it, the ends of which are folded up into the hollow top, and a cap of parchment tied over it 'till used.

When these fuzes are drove into the loaded shell, the lower end is cut off in a slope, so that the composition may inflame the powder in the shell: the fuze must have such a length as to continue burning all the time the shell is in its range, and to set fire to the powder as soon as it touches the ground, which instantly bursts into many pieces. When the distance of the battery from the object is known, the time of the shell's flight may be computed to a second or two; which being known, the fuze may be cut accordingly, by burning 2 or 3, and making use of a watch or a string by way of a pendulum to vibrate seconds. See Table of Loaded-shells Experiments.

Table of FUZES, *containing the greatest ranges corresponding to a given time of flight, and the length of fuze, allowing* 4, 4½, *or* 5 *seconds to each inch of fuze.*

Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards	Time in seconds	Fuze in inches			Range in yards
	4	4.5	5			4	4.5	5			4	4.5	5	
1	0.25	0.22	0.20	5	5¼	1.31	1.17	1.05	148	9½	2.38	2.11	1.90	485
¼	0.31	0.28	0.25	8	½	1.38	1.22	1.10	162	¾	2.44	2.17	1.95	510
½	0.38	0.33	0.30	12	¾	1.44	1.28	1.15	178	10	2.50	2.22	2.00	537
¾	0.44	0.40	0.35	16	6	1.50	1.33	1.20	193	¼	2.56	2.28	2.05	564
2	0.50	0.44	0.40	21	¼	1.56	1.40	1.25	210	½	2.60	2.33	2.10	592
¼	0.56	0.50	0.45	27	½	1.63	1.44	1.30	227	¾	2.69	2.40	2.15	621
½	0.62	0.55	0.50	34	¾	1.69	1.50	1.35	245	11	2.75	2.44	2.20	650
¾	0.69	0.61	0.55	41	7	1.75	1.56	1.40	263	¼	2.81	2.50	2.25	680
3	0.75	0.66	0.60	48	¼	1.81	1.61	1.45	282	½	2.88	2.56	2.30	710
¼	0.81	0.72	0.65	57	½	1.88	1.67	1.50	302	¾	2.94	2.61	2.35	741
½	0.88	0.78	0.70	66	¾	1.94	1.72	1.55	323	12	3.00	2.67	2.40	773
¾	0.94	0.83	0.75	76	8	2.00	1.78	1.60	344	¼	3.06	2.72	2.45	806
4	1.00	0.90	0.80	86	¼	2.06	1.83	1.65	365	½	3.13	2.78	2.50	839
¼	1.06	0.94	0.85	97	½	2.13	1.89	1.70	388	¾	3.19	2.83	2.55	873
½	1.13	1.00	0.90	109	¾	2.19	1.95	1.75	411	13	3.25	2.89	2.60	908
¾	1.19	1.06	0.95	121	9	2.25	2.00	1.80	435	¼	3.31	2.95	2.65	943
5	1.25	1.11	1.00	134		2.31	2.06	1.85	459	½	3.38	3.00	2.70	979

Conti-

Continuation of the Table.

Time in seconds	Fuze in inches			Range in yards
	4	4.5	5	
13¾	3.44	3.06	2.75	1015
14	3.50	3.11	2.80	1053
¼	3.56	3.17	2.85	1090
½	3.63	3.22	2.90	1129
¾	3.69	3.28	2.95	1168
15	3.75	3.33	3.00	1208
¼	3.81	3.40	3.05	1249
½	3.88	3.44	3.10	1290
¾	3 94	3.50	3.15	1332
16	4.00	3.56	3.20	13 5
¼	4.06	3.61	3.25	1418
½	4.13	3.67	3.30	1462
	4.19	3.72	3.35	1507
17	4.25	3.78	3.40	1552
¼	4.31	3.83	3.45	1598
½	4.38	3.89	3.50	1645
¾	4.44	3.95	3.55	1692
18	4.50	4.00	3.60	1740
¼	4.56	4.06	3.65	1789
½	4.63	4.11	3.70	1838
¾	4.69	4.1	3.75	1888
19	4.75	4.22	3.80	1939
¼	4.81	4.28	3.85	1990
½	4.88	4.33	3.90	2040
¾	4.94	4.40	3.95	2095
20	5.00	4.44	4.00	2148

Time in seconds	Fuze in inches			Range in yards
	4	.5	5	
20¼	5.06	4.50	4.05	2208
½	5.13	4.56	4.10	2257
¾	5.19	4.61	4.15	2311
21	5.25	4.67	4.20	2368
¼	5.31	4.71	4.25	2425
½	5.38	4.78	4.30	2482
¾	5.44	4.83	4.35	2540
22	5.50	4.89	4.40	2599
¼	5.56	4.95	4.45	2658
½	5.63	5.00	4.50	2719
¾	5.69	5.06	4.55	2779
23	5.75	.11	4.60	2841
¼	5.81	5.17	4.65	2903
½	5.88	5.22	4.70	2966
¾	5.94	5.28	4.75	3029
24	6.00	5.33	4.80	3093
¼	6.06	5.40	4.85	3158
½	6.13	5.44	4.90	3223
¾	6.19	5.50	4.95	3289
25	6.25	5.56	5.00	3356
¼	6.31	5.61	5.05	3424
½	6.38	5.67	5.10	3492
¾	6.44	5.72	5.15	3561
26	6.50	5.78	5.20	3630
¼	6.56	5.83	5.25	3700
½	6.63	5.89	5.30	3771

Time in seconds	Fuze in inches			Range in yards
	4	4.5	5	
26¾	6.69	5.95	5.35	3843
27	6.75	6.00	5.40	1315
¼	6.81	6.06	5.45	3988
½	6.88	6.11	5.50	4061
¾	6.94	6.17	5.55	4135
28	7.00	6.22	5.60	4210
¼	7.06	6.28	5.65	4286
½	7 13	6.33	5.70	4362
¾	7.19	6.40	5.75	4439
29	7.25	6.44	5.80	4516
¼	7.31	6.50	5.85	4594
½	7.38	6.56	5.90	4673
¾	7.44	6.61	.95	4753
30	7.50	6.67	6.00	4833
¼	7.56	6.72	6.05	4914
½	7.63	6.78	6.10	49 5
¾	7.69	6.83	6.15	5078
31	7.75	6.89	6.20	5161
¼	7.81	6.95	6.25	5244
½	7.88	7.00	6.30	5328
¾	7.94	7.06	6.35	5413
32	8.00	7.11	6.40	5499
¼	8.06	7.17	6.45	5585
½	8.13	7.22	6.50	5662
¾	8.19	7.28	6.55	5760

N. B. The use of this table is obvious from inspection only. The use of the following table is to know the proper length of fuzes for all the different mortars, and their compositions for any proposed range; and, as fuzes burn equal lengths in equal times, hence the following rule. For instance, the range of an 8-inch shell is ordered to be 1206 yards: Quære, the length of the fuze. Say, As 32 seconds is to 7 inches, so is 15 seconds to 3.28 inches, the fuze's length required.

Second Table *of* Fuzes.

Nat. of mortar	Total length of fuze		Diam. of fuze at neck		Diam. at the end		Diam. at the cap.		Length of composit.		Time of burning		Diam. of composit.		Diam. of fuze-holes	
inch.	in.	pts.	in.	pts.	in.	pts.	in.	pts.	in.	pts.	″	‴	in.	pts.	in.	pts.
13	10	5	2	2	1	47	2	5	8		35			58	1	7 1/16
10	9	36	1	65	1	5	1	86	7	5	33			51	1	5/8
8	8	5	1	6	1	1	1	86	7		32	5		42	1	3/16
roy.	4	5	1	2		86	1	3	3	75	22			25		
coh.	4		1			6	1	1	3	¼	19	10		25		

Grape-ſhot, in *artillery*, is a combination of ſmall ſhot, put into a thick canvas bag, and corded ſtrongly together, ſo as to form a kind of cylinder, whoſe diameter is equal to that of the ball which is adapted to the cannon.

To make grape-ſhot, a bag of coarſe cloth is made juſt to hold the bottom which is put into it; then as many ſhot as the grape is to contain; and with a ſtrong pack-thread they are quilted to keep the ſhot from moving; and, when finiſhed, they are put into boxes for carriage, to be tranſported wherever it is neceſſary.

The number of ſhot in a grape varies according to the ſervice or ſize of the guns: in ſea-ſervice 9 is always the number; but by land it is increaſed to any number or ſize, from an ounce and a quarter in weight, to 4 pounds. It has not yet been determined, with any degree of accuracy, what number and ſize anſwers beſt in practice; for it is well known, that they often ſcatter ſo much, that only a ſmall number take place. See PRACTICE.

Experiments with land GRAPE-SHOT, *of* 34 *balls for a* 6*-pounder*, 28 *for a* 3*-pounder, and* 20 *for a* 1½*-pounder, againſt a canvaſs* 12 *feet ſquare, the centre* 6 *feet from the ground, in* 1768.

Nat. pdrs.	Powder lb.	Powder oz.	Line of metal feet	Diſt. feet	Shot thro'	Remarks
6	1		2½ under cent.	600	8	Grazed at a great diſtance.
	1	8	2½ ditto	ditto	3	Reſt cloſe, a good grape.
	2		9 in. ditto	750	2	Spread round the object.
	2	8	2 under ditto	900	.	Grazed before the object.
	3		3 under ditto	ditto	3	Very good grape. Some ſhort.
3		8	centre	600		Grazed from 15 to 20 feet ſhort.
		12	ditto	680	6	Spread well.
		14	ditto	678	5	Spread well.
1½		6	2 feet over	750	2	Spread too high.
		6	centre	900	3	Ditto.

In this and the following table the columns are eaſily underſtood. By *greateſt effect*, in the following table, is meant the effect of the beſt round in four, which were fired each at 30 minutes difference of elevation, beginning at 0 degrees; and that effect (or number through the curtain) is expreſſed in decimal parts of the whole charge of grape; i. e. .33 means 33 hundredth parts of 9 lb. 4 oz. = 3.3 lb. nearly: ſo that if each experiment were ſufficiently purſued, theſe numbers would exhibit the comparative powers or fitneſs of each different kind of piece for grape-ſhot, &c.

Ordnance calib.	Ordnance length	Ordnance weight	Weight of powder lb.	Weight of powder oz.	Weight of grape lb.	Weight of grape oz.	Greateſt effect at 200 yards. proportional parts.	Greateſt effect at 200 yards. weight of grape thro' lb.	Greateſt effect at 300 yards proportional parts.	Greateſt effect at 300 yards weight of grape thro' lb.
	F. In.	c. qr. lb.	4	8	9	14	.31	3.4	.33	3.3
heavy 6-pdr.	8 0	18 3 13	3	0	5	8	.31	1.6	.23	1.2
			2	0	9	14			.22	2.
			2	c	5	8			.29	1.6
light 6-pdr.			2	.c	9	14	.34	3.4	.29	2.9
	4 6	5 1 15	1	8	5	8	.39	2.1	.38	2.
3-pdr.	3 6	2 2 19	1	0	5	0	.42	2.	.30	1.5
			0	12	5	0	.62	1.8	.40	1.2
	chaſe									
8-in. how.	2 1½	11 3 c	2	0	38	4	.55	20.	.27	10.
5½ dit.	1 6	4 1 1c	1	c	13	8	.27	3.6	.22	3.

Hence

Hence, it is to be obferved, that of the 3 different forts of cannon ufed in thefe experiments, the 3-pounder feems rather the beft, proportionally; that is, it throws the largeft fhare through the curtain; often its half-charge at that diftance: fo that the effect of two 3-pounders is much greater than that of one 6-pounder. But the 8-inch howitzer, which can be made to throw in from 3 to 5 of its charge (from 12 to 20 lb. of fhot) becomes thereby a very formidable piece, when it can be ufed for grape-fhot.

Proper charges for grape-fhot have never yet been effectually determined: we can only give our advice from fome experiments; that for heavy 6-pounders 1-3d of the weight of the fhot appears to be the beft charge of powder; for the light 6-pounders, 1-4th of the weight of the fhot; and for howitzers, 1-8th or 1-10th anfwers very well.

This kind of fire feems not yet to have been enough refpected, nor depended on. However, if cannon and howitzers can be made to throw 1-3d or 1-4th, and fometimes ½ their charge of grape-fhot into a fpace 39 × 12 feet, at 200 and 300 yards diftance, and thofe fired 10 or 12 times in a minute; it furely forms the thickeft fire that can be produced from the fame fpace.

Tin-cafe-fhot, in *artillery*, is formed by putting a great quantity of fmall iron fhot into a cylindrical tin-box, called a canifter, that juft fits the bore of the gun. Leaden bullets are fometimes ufed in the fame manner; and it muft be obferved, that whatever number or fizes of the fhots are ufed, they muft weigh, with their cafes, nearly as much as the fhot of the piece.

Cafe-fhot, formerly, confifted of all kinds of old iron, ftones, mufket-balls, nails, &c. and ufed as above.

Table *of* Tin-Case-Shot.

Nature of pounders	Shot Wt.	Shot N°.	Wt. of tin cafe	Length of cafe	Length fixed	Diam. of fhot	Weight finifhed		Number in one pound
	oz.	N°.	oz.	inch.	inch.	in. pts.	lb.	oz.	
42	6	94	15½	8¾	1¼	1.526	39	2½	2
32	6	72	15	8¼	1	1.030	27	2	2½
24 G	6¾	48	13½	8	1	1.410	21	12½	2⅔
24 F	4	84	13½	8	1	1.211	21	13½	4
18	4¾	38	9½	7¾	1	1.410	17	3½	2⅔
12 G	2	43	7½	6¼	7/8	1.211	10	12½	4
12 F	1½	107	7½	6½	7/8	.961	10	8½	11⅖
9	2	73	5½	6	6/19	1.001	8	12½	5 4/16
9 G	3	27	4¼	5	6/10	1.000	5	5½	5 4/16
6 F	1¼	56	4¼	5	6/18	.762	5	3	12
3	1⅛	34	2¼	4	5/10	.953	2	9⅝	14¼
1½	1⅕	17	1¾	3 9/10	5/10	.953	1	5⅝	14¼
5½ H	6	70	8¼	4 2/10	1	.961	9	4½	12
7¾ H	6¾	72	14	6 2/10	1	1.410	32	6	2⅔

Explanation.—G ftands for garrifon-pieces, F for field-pieces, and H for howitzers.

Tubes, in *artillery*, are made ufe of in quick firing. They are made of tin: their diameter is 2-10ths of an inch, being juft fufficient to enter into the vent of the piece; about 6 inches long, with a cap above, and cut flanting below, in the form of a pen: the point is ftrengthened with fome folder, that it may pierce the cartridge without bending. Through this tube is drawn a quick-match, the cap being fitted with mealed powder, moiftened with fpirits of wine. To prevent the mealed powder from falling out by carriage, a cap of paper or flannel, fteeped in fpirits of wine, is tied over it.

Fire-fhip, a veffel filled with combuftible materials, and fitted with grappling-irons to hook, and fet fire to the enemy's fhips in battle, &c.

From the bulk-head at the forecaftle to a bulk-head to be raifed behind the main chains, on each fide and acrofs the fhip at the bulk-heads, is fixed, clofe to the fhip-fides, a double row of troughs, 2 feet diftance from each other, with crofs troughs quite round, at about 2½ diftance; which are mortifed into the others. The crofs troughs lead to the fides of the fhip, to the barrels, and to the port-holes, to give fire both to the barrels and to the chambers, to blow open the ports; and the fide-troughs ferve to com-

communicate the fire all along the ſhip and the croſs troughs.

The timbers of which the troughs are made, are about 5 inches ſquare; the depth of the troughs, half their thickneſs; and they are ſupported by croſs pieces at every 2 or 3 yards, nailed to the timbers of the ſhip, and to the wood-work which incloſes the fore and main maſts. The decks and troughs are all well paved with melted roſin.

On each ſide of the ſhip 6 ſmall port-holes are cut, from 15 to 18 inches large, the ports opening downwards, and are cloſe caulked up. Againſt each port is fixed an iron chamber, which, at the time of firing the ſhip, blows open the ports, and lets out the fire. At the main and fore chains, on each ſide, a wooden funnel is fixed over a fire-barrel, and comes through a ſcuttle in the deck, up to the ſhrouds, to ſet them on fire. Both funnels and ſcuttles muſt be ſtopped with plugs, and have ſail-cloth or canvaſs nailed cloſe over them, to prevent any accident happening that way, by fire, to the combuſtibles below.

The port-holes, funnels, and ſcuttles, not only ſerve to give the fire a free paſſage to the outſide and upper parts of the ſhip, and her rigging, but alſo for the inward air (otherwiſe confined) to expand itſelf, and puſh through thoſe holes at the time of the combuſtibles being on fire, and prevent the blowing up the decks, which otherwiſe muſt of courſe happen, from ſuch a ſudden and violent rarefaction of the air as will then be produced.

In the bulk-head behind, on each ſide, is cut a ſmall hole, large enough to receive a trough of the ſame ſize of the others; from which, to each ſide of the ſhip, lies a leading trough, one end coming through a ſally-port cut through the ſhip's ſide, and the other fixing into a communicating trough that lies along the bulk-head, from one ſide of the ſhip to the other; and being laid with quick-match, at the time of firing either of the leading troughs, communicates the fire in an inſtant to the contrary ſide of the ſhip, and both ſides burn together.

Fire-barrels, for a fire-ſhip, are cylindric, on account of that make anſwering better both for filling them with reeds, and for ſtowing them between the troughs: their inſide diameters are about 21 inches, and their length 33. The bottom parts are firſt filled with double-dipt reeds ſet on end, and the remainder with fire-barrel compoſition, which is, corned powder 30 lb. Swediſh pitch 12, ſaltpetre 6, and tallow 3, well mixed and melted, and then poured over them.

There are 5 holes of $\frac{3}{4}$ inches diameter, and 3 inches deep, made with a drift of that ſize in the top of the compoſition while it is warm; one in the centre, and the other four at equal diſtances round the ſides of the barrel. When the compoſition is cold and hard, the barrel is primed by well driving thoſe holes full of fuze compoſition, to within an inch of the top; then fixing in each hole a ſtrand of quick-match twice doubled, and in the centre-hole two ſtrands the whole length; all which muſt be well drove in with mealed powder: then lay the quick-match all within the barrel, and cover the top of it with a dipt curtain, faſtened on with a hoop to ſlip over the head, and nailed on.

Bavins, for a fire-ſhip, are made of birch, heath, or other ſort of bruſh-wood, that is both quickly fired, and tough: in length 2.5, or 3 feet; the buſh-ends all laid one way, and the other ends tied with two bands each. They are dipped and ſprinkled with ſulphur the ſame as reeds, only that the buſh-ends alone are dipped, and ſhould be a little cloſed together by hand, as ſoon as done, to keep them more cloſe, in order to give a ſtronger fire, and to keep the branches from breaking in ſhifting and handling them. Their compoſition is, roſin 120 lb. coarſe ſulphur 90, pitch 60, tallow 6, and mealed powder 12; with ſome fine ſulphur for ſalting.

Iron-chambers, for a fire-ſhip, are 10 inches long, and 3.5 in diameter; breeched againſt a piece of wood fixed acroſs the port-holes. When loaded, they are almoſt filled full of corned powder, with a wooden tompion well drove into their muzzles. They are primed with a ſmall piece of quick-match thruſt through their vents into the powder, with a part of it hanging out; and when the ſhip is fired, they blow open the ports, which either fall downwards, or are carried away, and ſo give vent to the fire out of the ſides of the ſhip.

Curtains, for a fire-ſhip, are made of barras, about $\frac{3}{4}$ of a yard wide, and 1 yard in length: when they are dipped, 2 men, with each a fork, muſt run the prongs through the corner of the curtain at the ſame end; then dip them into a large kettle of compoſition (which is the ſame as the compoſition for bavins) well melted; and when well dipped, and the curtain extended to its full breadth, whip it between 2 ſticks of about 5.5 feet long, and 1.5 inches ſquare, held cloſe by 2 other men to take off the ſuperfluous compoſition hanging to it; then immediately ſprinkle ſaw-duſt on both ſides to prevent its ſticking, and the curtain is finiſhed.

Reeds, for a fire-ſhip, are made up in ſmall bundles

bundles of about 12 inches in circumference, cut even at both ends, and tied with two bands each: the longest sort is 4 feet, and the shortest 2.5; which are all the lengths which are used. One part of them are single-dipped, only at one end; the rest are double-dipped, i. e. at both ends. In dipping, they must be put about 7 or 8 inches deep into a copper kettle of melted composition (the same as that for bavins); and when drained a little over it, to carry off the superfluous composition, sprinkle them over a tanned hide with pulverised sulphur, at some distance from the copper.

STORES *for a* FIRE-SHIP *of* 150 *tons.*

	Number.	Value.
Fire-barrels	8	£.80 0 0
Iron chambers	12	£.12 0 0
Priming composition barrels	3½	21 0 0
Quickmatch barrels	1	3 0 0
Curtains dipped	30	3 0 0
Long reeds single dipped	150	10 15 0
Short reeds double dipped	75	2 18 9
Short reeds single dipped	75	1 17 6
Bavins single dipped	209	10 0 0
		£.144 11 3

Quantity of COMPOSITION *for preparing the stores of a* FIRE-SHIP.

	Petre	Sulphur	Corned Powder	Pitch	Rosin	Tallow	Tar	Oil-pots
For 8 barrels - - - - - -			960	480		80		
For 3 barrels of priming composition - -	175	140	350		21			11
For curtains, bavins, reeds, and sulphur to salt them		200		350	175	50	25	
Total	175	340	1310	830	196	130	25	11

Total weight of the composition 3107 pounds, equal to C. 26: 3: 2.

Composition allowed for the reeds and barrels, $\frac{1}{5}$ of the whole of the last article, which is equal to 160 lb. making in the whole 3177 pounds, or C. 28: 1: 13.

Port-fires, in *artillery*, may be made any length: however, they are seldom made more than 21 inches. The interior diameter of port-fire moulds should be $\frac{10}{16}$ of an inch, and the diameter of the whole port-fire about ½ an inch. The paper cases must be rolled wet with paste, and one end folded down. They are used instead of matches to fire artillery. The composition of wet port-fires is, salt-petre 6, sulphur 2, and mealed powder 1; when it is well mixed and sieved, it is to be moistened with a little linseed oil: the composition for dry port-fire is, salt-petre 4, sulphur 1, mealed powder 2, and antimony 1.

Rockets, in *pyrotechny*, an artificial firework, consisting of a cylindrical case of paper, filled with a composition of certain combustible ingredients; which, being tied to a stick, mounts into the air to a considerable height, and there bursts: they are frequently used as signals in war time.

Composition for sky-rockets in general is, salt-petre 4 lb. brimstone 1 lb. and charcoal 1½ lb: but for large sky-rockets, salt-petre 4 lb. meal-powder 1 lb. and brimstone 1 lb: for rockets of a middling size, salt-petre 3 lb. sulphur 2 lb. meal-powder 1 lb. and charcoal 1 lb.

Quick-match, in *artillery*, is of 2 sorts, cotton and worsted: the first is generally made of such cotton as is put in candles, of several sizes, from 1 to 6 threads thick, according to the pipes it is designed for. The ingredients are, cotton 1 lb. 12 oz. salt-petre 1 lb. 8 oz. spirits of wine 2 quarts, water 2 quarts, isinglass 3 gills, and meal powder 10 lb: it is then taken out hot, and laid in a trough where some mealed powder, moistened with spirits of wine, is thoroughly wrought into the cotton. This done, they are taken out separately, and drawn through mealed powder, and hung upon a line to dry.—The composition for the second is, worsted 10 oz. mealed powder 10 lb. spirits of wine 3 pints, and white-wine vinegar 3 pints.

Scaling-LADDERS, are used in scaling when a place is to be taken by surprise. They are made several ways: here, we make them of flat staves, so as they may move about their pins,

pins, and shut like a parallel ruler, for conveniently carrying them: the French make them of several pieces, so as to be joined together, and to be made of any necessary length: sometimes they are made of single ropes, knotted at proper distances, with iron hooks at each end, one to fasten them upon the wall above, and the other in the ground; and sometimes they are made with 2 ropes, and staves between them, to keep the ropes at a proper distance, and to tread upon. When they are used in the action of scaling walls, they ought to be rather too long than too short, and to be given in charge only to the stoutest of the detachment. The soldiers should carry these ladders with the left arm passed through the second step, taking care to hold them upright close to their sides, and very short below, to prevent any accident in leaping into the ditch.

The first rank of each division, provided with ladders, should set out with the rest at the signal, marching resolutely with their firelocks slung, to jump into the ditch: when they are arrived, they should apply their ladders against the parapet, observing to place them towards the salient angles rather than the middle of the curtain, because the enemy have less force there. Care must be taken to place the ladders within a foot of each other, and not to give them too much nor too little slope, so that they may not be overturned or broke with the weight of the soldiers mounting upon them.

The ladders being applied, they who have carried them, and they who come after, should mount up, and rush upon the enemy sword in hand: if he who goes first, happens to be overturned, the next should take care not to be thrown down by his comrade; but, on the contrary, immediately mount himself, so as not to give the enemy time to load his piece.

As the soldiers who mount first may be easily tumbled over, and their fall may cause the attack to fail, it would perhaps be right to protect their breasts with the fore-parts of cuirasses; because, if they can penetrate, the rest may easily follow.

The success of an attack by scaling is infallible, if they mount the 4 sides at once, and take care to shower a number of grenades amongst the enemy, especially when supported by some grenadiers and picquets, who share the attention and fire of the enemy.

LADLES, in *gunnery*, are made of copper, to hold the powder for loading of guns, with long handles of wood, when cartridges are not used.

LADLES, in *laboratory business*, are very small, made of copper, with short handles of wood, used in filling the fuzes of shells, or any other composition, to fill the cases of sky-rockets, &c.

LANCE, or *javelin*, a sort of weapon, much used of old.

To LANCE, to throw a lance.

LANE, in a *military sense*, is where men are drawn up in two ranks facing one another, as in a street, for any great person to pass through, or sometimes for a soldier to run the gantlope.

LANS-PESATE, } LANCE-PESATE, } in some of the *foreign troops*, is a soldier that does duty as a corporal, especially on guards and detachments.

LANTERN, } LANTHORN, } commonly called Muscovy lanterns, being a kind of dark-lanterns, used in the field, when dark, to light the gunners in the camp to prepare the stores, &c.

LASING-RINGS, } LASHING-RINGS, } in *artillery*, with hoops, fixed on the side-pieces of travelling carriages, to lash the tarpauling, as also to tie the sponge, rammer, and ladle. See CARRIAGE.

LATH, in *building*, a long, thin, and narrow slip of wood, nailed to the rafters of a roof or cieling, in order to fasten the covering. They are distinguished into three kinds, according to the different kinds of wood of which they are made, viz. heart of oak, sap-laths, deal-laths, &c.

LATITUDE, in *geography*, the distance of any place from the equator, measured in degrees, minutes, seconds, &c. upon the meridian of that place; and is either north or south, according as the place is situated either on the north or south side of the equator. See GEOGRAPHY.

LAW *of arms*, is a law which gives precepts how to proclaim a war, to attack the enemy, and to punish offenders in the camp.

Military-LAW. See COURTS-MARTIAL.

LAW *of marque*, or *letters of marque*, that by which persons take the goods or shipping of the party that has wronged them, as in time of war, whenever they can take them within their precincts.

LAZARUS, } LAZARO, } a military order instituted at Jerusalem by the Christians of the West, when masters of the holy land, who received pilgrims under their care, and guarded them on the roads from the insults of the Mahometans. This order was instituted in the year 1119, and confirmed by a bull of pope Alex-

Alexander IV. in 1255, who gave it the rule of St. Auguſtine.

LEAD, a metal well known: it is employed for various mechanic uſes; as in thin ſheets for covering buildings, for pipes, pumps, ſhot, bullets, windows, for ſecuring iron bars in hard ſtones, for ſundry kinds of large veſſels for evaporation, and many other mechanic purpoſes. See BALLS.

LEAGUE, in *military hiſtory*, a meaſure of length, containing more or leſs geometrical paces, according to the different uſages and cuſtoms of countries. A league at ſea, where it is chiefly uſed by us, being a land-meaſure moſtly peculiar to the French and Germans, contains 3000 geometrical paces, or 3 Engliſh miles.

The French league ſometimes contains the ſame meaſure, and, in ſome parts of France, it conſiſts of 3500 paces: the mean or common league conſiſts of 2400 paces, and the little league of 2000. The Spaniſh leagues are larger than the French, 17 Spaniſh leagues making a degree, or 20 French leagues, or 69 and ½ Engliſh ſtatute miles. The German and Dutch leagues contain each 4 geographical miles. The Perſian leagues are pretty near of the ſame extent with the Spaniſh; that is, they are equal to 4 Italian miles, which is pretty near to what Herodotus calls the length of the Perſian paraſang, which contained 30 ſtadia, 8 whereof, according to Strabo, make a mile.

LEAGUE, alſo denotes an alliance or confederacy between princes and ſtates for their mutual aid, either in attacking ſome common enemy, or in defending themſelves.

LEGATUS, in *Roman antiquity*, a military officer who commanded as deputy of the chief general.

LEGION, in *Roman antiquity*, a body of foot which conſiſted of ten cohorts.

The exact number contained in a legion, was fixed by Romulus at 3000; though Plutarch aſſures us, that, after the reception of the Sabines into Rome, he increaſed it to 6000. The common number afterwards, in the firſt times of the free ſtate, was 4000; but, in the war with Hanibal, it roſe to 5000; and after that, it is probable that it ſunk again to 4200, which was the number in the time of Polybius.

LETTER *of mart*, } LETTER *of marque*, } a letter granted to one of the king's ſubjects, under the privy-ſeal, impowering him to make repriſals for what was formerly taken from him by the ſubjects of another ſtate, contrary to the law of mart. See MARQUE.

LETTER *of mart*, a commiſſion granted by the lords of the admiralty, or by the vice-admiral of any diſtant province, to the commander of a merchant ſhip, or privateer, to cruiſe againſt, and make prizes of the enemy's ſhips and veſſels, either at ſea, or in their harbours.

LEVEL, an inſtrument to draw a line parallel to the horizon, whereby the difference of aſcent or deſcent between ſeveral places may be found, for conveying water, draining fens, &c.

Air-LEVEL, that which ſhows the line of level by means of a bubble of air, incloſed with ſome liquor in a glaſs tube of an indeterminate length and thickneſs, whoſe two ends are hermetically ſealed. When the bubble fixes itſelf at a certain mark, made exactly in the centre of the tube, the plane or ruler wherein it is fixed is level: when it is not level, the bubble will riſe to one end. This glaſs tube may be ſet in another of braſs, having an aperture in the middle, whence the bubble of air may be obſerved. There is one of theſe inſtruments with ſights, being an improvement upon the laſt deſcribed, which, by the addition of more apparatus, becomes more commodious and exact: it conſiſts of an air-level about 8 inches long, and 7 or 8 lines in diameter, ſet in a braſs tube, with an aperture in the middle: the tubes are carried in a ſtrong ſtraight ruler, a foot long, at whoſe ends are fixed two ſights, exactly perpendicular to the tubes, and of an equal height, having a ſquare hole, formed by two fillets of braſs croſſing each other at right angles, in the middle whereof is drilled a very little hole, through which, a point on a level with the inſtrument is deſcribed: the braſs tube is faſtened on the ruler by means of two ſcrews, one whereof ſerves to raiſe or depreſs the tube at pleaſure, for bringing towards a level. The top of the ball and ſocket is riveted to a little ruler that ſprings, one end whereof is faſtened with ſcrews to the great ruler, and at the other end is a ſcrew ſerving to raiſe and depreſs the inſtrument when nearly level.

Artillery foot-LEVEL, is in form of a ſquare, having its two branches or legs of an equal length, at the angle of which is a ſmall hole, whence hangs a line and plummet, playing on a perpendicular line in the middle of a quadrant: it is divided into twice 45 degrees from the middle. (Pl. XII. fig. 5.)

Gunner's-LEVEL, for levelling pieces of artillery, conſiſts of a triangular braſs plate, about 4 inches, at the bottom of which is a portion of a circle divided into 45 degrees; which angle is ſufficient for the higheſt elevation of cannons,

mor-

mortars, and howitzers, and for giving ſhot and ſhells the greateſt range: on the centre of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure; the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhow the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs foot, to ſet upon cannon or mortars, ſo that when theſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree, &c. (Fig. 6.)

The moſt curious inſtrument for the uſe of the artilleriſt, was lately invented by the very ingenious Capt. Congreve, of the royal artillery; having the following qualifications, viz. 1. It will find the inclination of any plane, whether above or below the horizon. 2. By applying it either to the cylinder, or outſide, of any piece of ordnance, angles of elevation or depreſſion may be given to the 60th part of a degree, with leſs trouble than the common gunner's quadrant, which only gives to the 4th part of a degree. 3. It will give the line of direction for laying either guns or mortars to an object above or below the horizon. 4. It will find the centre of metal of any piece of ordnance. 5. With it, a point may be found in the rear of a mortar-bed, in the vertical plane of the mortar's axis; conſequently a longer line of ſight is given for directing them to the object than the uſual way. 6. It anſwers all the purpoſes of a pair of callipers, with the advantage of knowing (to the 100th part of an inch) diameters whether concave or convex, without the trouble of laying the claws upon a diagonal ſcale. 7. On the ſides of the inſtrument are the following lines, viz. equal parts, ſolids, plains and polygons, logarithms, tangents, verſed ſines, ſines and numbers, plotting ſcales, and diagonal ſcale of inches for cutting fuzes by. 8. In the lid of the inſtrument-caſe is a pendulum to vibrate half-ſeconds. It is likewiſe of ſingular uſe in ſurveying; as, 1. It takes horizontal angles to the 60th part of a degree. 2 Vertical angles. 3. Levels. 4. Solves right-angled plane triangles. 5. Oblique-angled plane triangles. 6. Anſwers all the purpoſes of a protractor, with the advantage of laying down angles exactly as taken in the field. N. B. Capt. Jordane's ingenious inſtrument anſwers nearly the ſame purpoſes.

LEVELLING, the finding a line parallel to the horizon at one or more ſtations, and ſo to determine the height of one place in regard to another.

A truely level ſurface is a ſegment of any ſpherical ſurface, which is concentric to the globe of the earth. A true line of level is an arch of a great circle which is imagined to be deſcribed upon a truely level ſurface.

The apparent level is a ſtraight line drawn tangent to an arch or line of a true level. Every point of the apparent level, except the point of contact, is higher than the true level: thus (Plate VI. fig. 1.) let *E A G* be an arch of a great circle drawn upon the earth: to a perſon who ſtands upon the earth at *A*, the line *H D* is the apparent level, parallel to his rational horizon *R R*; but this line, the further it is extended from its ſtation *A*, the further it recedes from the centre; for *B C* is longer than *A C*, and *D C* is longer than *B C*, &c.

The common methods of levelling are ſufficient for laying pavements of walks, for conveying water to ſmall diſtances, for placing horizontal dials, or aſtronomical inſtruments; but in levelling the bottoms of canals or ditches in a fortification, which are to convey water to the diſtance of many miles, the difference between the apparent and true level muſt be taken into the account: thus (fig. 2.) let *I A L* be an arch of a great circle upon the earth; let it be required to cut a canal, whoſe bottom ſhall be a true level from *A* to *B*, of the length of 5078 feet. The common method is, to place the levelling inſtrument in the bottom of the canal at *A*, and looking through the ſights placed horizontally at a ſtick ſet up perpendicular at *B*, to make a mark where the viſual ray or line of the apparent level points at *E*, and then to ſink the bottom of the canal at *B*, as much below *E* as *A* is below *D*: but this will not give us a true level; for, according to Caſſini's calculation, at the diſtance of 5078 feet, the apparent level is 7 inches above the true; and therefore, to make a true level, *B* muſt be ſunk 7 inches lower than the apparent level directs; ſo that, if *A* be 4 feet below *D*, *B* muſt be 4 feet 7 inches below the mark *E*. We have here mentioned the error which will ariſe from placing the level at one end of the line to be levelled, and ſhown how to correct it; but, in moſt caſes, it is better to make a ſtation in the middle of the line to be levelled: thus, if the points *H* and *B* are to be levelled, place the inſtrument in the middle at *A*, and, ſetting up ſticks perpendicular at *H* and *B*, make marks upon each ſtick where the apparent level points, as *E* and *F*: thoſe points are level; and, if you ſink *H* as much below *F*

as

as *B* is below *E*, *H A B* will be a true level. When the bottom of a canal is thus truely level, if water be let in at one end, it will rise to the same height at the other. If water be required to run with any velocity, that is of another consideration: a river will run, though very slowly, which hath not 6 inches descent below the true level for a mile in length. If a river whose water is foul, be required to run with such a velocity as to carry its foulness into the sea, 16 inches, or at least 1 foot, fall below the true level, in a mile running, have been thought sufficient by persons skilled in that affair.

This we thought necessary to premise before we explained the method used in levelling, which is as follows. Suppose the height of the point *A* (Plate VI. fig. 3.) on the top of a mountain, above that of the point *B* at the foot thereof, be required; place the level about the middle distance, between the two points, as in *D*, and staves in *A* and *B*; and let there be persons instructed with signals for raising and lowering on the staves little marks of pasteboard, or any such matter: the level being placed horizontally, &c. look towards the staff *A E*, and cause the mark to be raised or lowered, till the middle, upper edge, or other most conspicuous part, appear in the visual ray; then measuring exactly the perpendicular height of the point *E* above *A*, which suppose 8 feet 6 inches, set that down in your book; then turn the level horizontally about, that the eye-glass of the telescope may be still next the eye, when you look the other way, (if you have only plain sights, the instrument need not be turned) and cause the person at the staff *B* to raise or lower the mark till some conspicuous part fall in the visual ray, as at *C*: then measure the perpendicular of *C* above *B*, which suppose 20 feet 8 inches; set this also down in the book above the other numbers: subtract the one from the other; the remainder will be 12 feet 2 inches, which is the difference of level between *A* and *B*, or the height of the point *A* above *B*.

If the point *D*, where the instrument is fixed, be in the middle between *A* and *B*, there will be no necessity for reducing the apparent level to the true, the visual ray being then equally raised above the true level.

If it be farther required to know whether there be a sufficient descent for conveying water from the spring *A* to the point *B* (fig. 4.) here, as the distance from *A* to *B* is considerable, it is requisite that several operations be made. Having then chosen a proper place for the first station, as at *I*, set up a staff in the point *A*, near the spring, with a proper mark to slide up and down the staff, as *L*; and measure the distance from *A* to *I*, which suppose 2000 yards. Then the level being adjusted in the point *K*, let the mark *L* be raised and lowered till you espy some conspicuous part through the telescope, or sights, and measure the height *A L*, which suppose 13 feet 5 inches. But in regard to the distance *A I*, which is 2000 yards, you must have recourse to your table for reduction, subtracting 11 inches, which will leave the height *A L* 12 feet 6 inches; and this note down in your book. Now turn the level horizontally, so as the eye-glass of the telescope may be towards the staff at *A*, and fixed upon another staff at *H*: cause the mark *G* to be moved up and down, till you can espy some conspicuous part: measure the height *H G*, which suppose 6 yards 4 feet 2 inches: measure likewise the distance of the points *I H*, which suppose 1300 yards; for which distance, 4 inches 8 lines must be subtracted from the height *H G*, which will leave but 6 yards, 3 feet, 9 inches, 4 lines, to be taken down in your book. This done, remove the level forwards to *E*, whence the staff *H* may be viewed, as also another staff at *D*; and proceed in every respect as before.

When a proper station for the level has been pitched upon between the two points, the two heights observed at that station must be written down in two columns; namely, under the first column, those observed when the eye was from the spring or towards the point, which may be called back-sights; and under the second column, those observed when the eye was next the spring, or the fore-sights.

Having summed up the height of each column separately, subtract the lesser from the greater, and the remainder will be the difference of level between *A* and *B*.

If the distance of the two points be required, add all the distances measured together; and, dividing the difference of height by the yards of the distances, for each 200 yards you will have a descent of about 2 inches 9 lines.

Dr. Halley suggests a new method of levelling, which is performed wholly by the barometer, in which the mercury is found to be suspended to so much the less height, as the place is more remote from the centre of the earth. Hence it follows, that the different height of the mercury in two places gives the difference of level.

Mr.

Mr. Derham, from some observations at the top and bottom of the monument in London, found that the mercury fell 1-10th of an inch at every 82 feet of perpendicular ascent, when the mercury was at 30 inches. Dr. Halley allows of 1-10th of an inch for every 30 yards; and, considering how accurately barometers are now made, we think this method sufficiently exact to take levels for the conveyance of water, or any other military purposes, and indeed less liable to errors than the common levels. Mr. Derham also found a difference of 3 inches 8-10ths between the height of the mercury at the top and bottom of Snowdon-hill, in Wales.

For the common occasions of levelling, set a pole upright in a spring, pond, &c. and mark how many feet and inches are above water; then set up another pole of equal length with the other, in the place to which the water is to come. Place the centre of a quadrant on the top of this last pole, the plummet hanging free; spy through the sights the top of the pole in the water, and if the thread cuts any degree of the quadrant, the water may be conveyed by a pipe laid in the earth. If you cannot see from one extreme to the other, the operation may be repeated.

Levelling *staves*, instruments used in levelling, that carry the marks to be observed, and at the same time measure the heights of those marks from the ground. These usually consist of 2 wooden square rulers, that slide over one another, and are divided into feet, inches, &c.

LEVER, in *mechanics*, an inflective line, rod, or beam, moveable about, or upon a fixed point, called the prop or fulcrum, upon one end of which is the weight to be raised; at the other end is the power applied to raise it, as the hand, &c.

Since the momentum of the weight and power are as the quantities of matter in each, multiplied by their respective celerities; and the celerities are as the distances from the centre of motion, and also as the paces passed through in a perpendicular direction in the same time; it must follow, that there will be an equilibrium between the weight and power, when they are to each other reciprocally as the distances from the centre, or as the celerities of the motions, or as the perpendicular ascent or descent in the same time; and this universally in all mechanical powers whatsoever, and which is therefore the fundamental principle of all mechanics. See Mechanical Powers.

LIEUTENANT, is the second commissioned officer in every company of both foot and horse, and next to the captain, and who takes the command upon the death or absence of the captain.

Lieutenant *of artillery*. Each company of artillery has 4; 1 first and 3 second lieutenants. The first lieutenant has the same detail of duty with the captain, because in his absence he commands the company: he is to see that the soldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and serviceable order; and to watch over every thing else, which may contribute to their health. He must give attention to their being taught their exercise, see them punctually paid, their messes regularly kept, and to visit them in the hospitals when sick. He must assist at all parades, &c. He ought to understand the doctrine of projectiles and the science of artillery, with the various effects of gunpowder, however managed or directed; to enable him to construct and dispose his batteries to the best advantage; to plant his cannon, mortars, and howitzers, so as to produce the greatest annoyance to an enemy. He is to be well skilled in the attack and defence of fortified places, and to be conversant in arithmetic, mathematics, and mechanics, &c.

Second Lieutenant, in the *artillery*, is the same as an ensign in an infantry regiment, being the youngest commissioned officer in the company, and must assist the first lieutenant in the detail of the company's duty. His other qualifications should be equal with those of the first lieutenant.

Lieutenant *of engineers*. See Engineers.
Lieutenant *colonel*. See Colonel.
Lieutenant *general*. See General.

Lieutenant *de roy*, the deputy-governor of all strong towns in France, who is a check upon the governor, and commands in his absence.

Lieutenant *reformed*, he whose company or troop is broke or disbanded, but continued in whole or half pay, and still preserves his right of seniority and rank in the army.

LIFE-GUARDS. See Guards.

LIGHT-HORSE. See Cavalry.

LIMBER, in *artillery*, a two-wheel carriage with shafts to fasten the trail of travelling-carriages by means of a pintle or iron pin, when travelling, and taken off on the battery, or when placed in the park of artillery; which is called unlimbering the guns. See Carriage.

LIME, in *military architecture*, is made of all kind of stones, that will calcine: that which is made of the hardest stones is the best, and

and the worst of all, that which is made of chalk.

Different counties in England produce different kinds of lime-stones. In Kent, abounding with chalk-pits, the lime is very bad. There are some rocks near Portsmouth, that make exceeding good lime. The best lime in England is that made of the marble in the neighbourhood of Plymouth. Before the stones are thrown into the kiln, they are to be broken into small pieces, otherwise the air contained in their cavities, being too much expanded by heat, makes them fly with so much violence as to damage the kilns. Lime will not be sufficiently burnt in less than 60 hours. The marks of well-burnt lime are, that its weight is to that of the stone in a sesquialterate proportion; that it be white, light, and sonorous; that when flaked, it sticks to the sides of the vessel, sending forth a copious thick smoke, and requires a great deal of water to flake it.

In some foreign parts they make good lime of all sorts of shells of sea-fish, which dries and hardens in a very short time; and when it is mixed with Dutch terras, is very fit for all kinds of aquatic works.

Lime should always be burnt with coals, and never with wood, the coals being strongly impregnated with sulphureous particles, which, mixed with the lime, make it more glutinous. See MORTAR.

LIMITS, in a *military sense*, is that distance which a centry is allowed on his post, namely, 50 paces to the right, and as many to the left; and though the weather be ever so bad, he must not get under cover.

LINCH-*pin*, in *artillery*, that which passes through the ends of the arms of an axle-tree, to keep the wheels or trucks from slipping off in travelling. See CARRIAGE.

LINCH-*clout*, in *artillery*, the flat iron under the ends of the arms of an axle-tree, to strengthen them, and to diminish the friction of the wheels. See CARRIAGE.

LINE, in *geometry*, a quantity extended in length only, without any breadth or thickness. It is formed by the flux or motion of a point.

There are two kinds of lines, viz. right lines and curve lines. Right lines are all those which go the nearest way to any given point. Curve lines are usually divided into geometrical and mechanical: the former are those which may be found exactly in all their points; the latter are those, some or all of whose points are not to be found precisely, but only tentatively, or nearly so.

Lines, considered as to their positions, are either parallel, perpendicular, or oblique, &c. Euclid's second book treats mostly of lines, and of the effects of their being divided, and again multiplied into one another.

LINE *of battle*, is the drawing up of an army for an engagement, extending its front as far as the ground will allow, that it may not be flanked. The Turkish armies often draw up in a curve line or half-moon, that, being very numerous, they may inclose the enemy. Christian armies generally form, or draw up, in 3 lines; the first called the *front*, the second the *centre*, and the third the *rear*; with a convenient distance between them, and intervals, so as not to put each other in confusion. See BATTLE.

LINES, in *fortification*, bear several names and significations; such as,

LINE of { *defence*, *defence fichant*, *defence razant*, *circumvallation*, *countervallation*, *counter-approach*, *defence prolonged* }
Capital LINE - - -
} See *Fortification*.

LINES *of communication*, are trenches that unite one work to another, so that men may pass between them without being exposed to the enemy's fire: thence the whole intrenchment round any place is sometimes called a *line of communication*, because it leads to all the works.

Inside LINES, are a kind of ditches towards the place, to prevent sallies, &c.

Outside LINES, are a kind of ditches towards the field, to hinder relief, &c.

To LINE, in a *military sense*, is nothing more than to environ a rampart, parapet, or ditch, &c. with a wall of masonry or earth.

To LINE *hedges*, &c. to plant troops, artillery, or small arms, along them under their cover, to fire upon an enemy that advances openly, or to defend them from the horse, &c.

To break the LINE, to change the direction from that of a straight line, in order to obtain a cross-fire.

LINES, in a *military sense*, a name given to all kinds of works made by an army from one town or strong post to another, behind which it is encamped, to guard a part of the country, &c.

If an army is so weak as to be within *lines*, you take care to have communications between the villages, and small parties of light-horse patroling towards the enemy, and to have videts and centries posted so near one another,

that you may have intelligence of all their tranſactions.

Turning out of the LINE, in a *military ſenſe.* The line turns out without arms whenever the general commanding in chief, comes along the front of the camp.

When the *lines* turn out, the private men are drawn up in a line with the bells-of-arms; the corporals on the right and left of their reſpective companies: the picquet forms behind the colours, with their accoutrements on, but without arms.

The ſerjeants draw up one pace in the front of the men, dividing themſelves equally.

The officers draw up in ranks, according to their commiſſions, in the front of the colours; two enſigns taking hold of the colours.

The field-officers advance before the captains.

The camp-colours on the flanks of the parade are to be ſtruck, and planted oppoſite to the bells-of-arms; the officers eſpontoons are to be planted between the colours, and the drums piled up behind them; the halberts are to be planted between, and on each ſide the bells-of-arms, and the hatchets turned from the colours.

LINE *of direction*, in *gunnery*, is a line formerly marked upon guns, by a ſhort point upon the muzzle, and a cavity on the baſe-ring, to direct the eye in pointing the gun; but is at preſent moſtly left off.

LINE *of* { *leaſt reſiſtance*, in *mining*. See MINING. *march.* See MARCH. *diſtance*, the interval between two things, either in regard to time, place, or quantity.

LINE *of gravitation*, of any heavy body, is a line drawn through its centre of gravity, and according to which it tends downwards.

LINE *of ſwifteſt deſcent*, of a heavy body, is the cycloid. See CYCLOID.

LINE { *of projectile.* See PROJECTILES. in *fencing*, that part of the body oppoſite to the enemy, wherein the ſhoulders, the right arm, and the ſword, ſhould always be found; and wherein are alſo to be placed the two feet at the diſtance of 18 inches from each other. In which ſenſe, a man is ſaid to be in his line, or to go out of his line, &c.

LINE, alſo denotes a French meaſure, containing 1-12th part of an inch. It is of late frequently made uſe of in our calculations. See FENCING.

LINKS, in the *art of war*, are diſtinct reins, or thongs of leather, uſed by the cavalry to link their horſes together, when they diſmount, that they may not diſperſe. Every tenth man is generally left to take care of them.

LINS-*pins.* See LINCH-PINS.

LINT-*ſtock*, in *gunnery*, a ſtick uſed by the gunners to faſten the match, which always keeps burning in time of action, ready to light the port-fires.

LIST, in a *military ſenſe*, incloſed ground in which combats are fought.

To enter the LISTS, is to contend with a perſon.

To LIST *ſoldiers*, } to retain and enroll as ſol-
To inliſt, } diers, either as volunteers, or by a kind of compulſion.

LISTING. Perſons liſted, to be carried within four days, but not ſooner than 24 hours after, before the next juſtice of peace of any county, riding, city, or place, or chief magiſtrate of any city or town-corporate (not being an officer in the army); and if, before ſuch juſtice or magiſtrate, they diſſent from ſuch inliſting, and return the inliſting-money, and alſo 20 ſhillings in lieu of all charges expended on them, they are to be diſcharged.

But ſuch perſons, refuſing or neglecting to return and pay ſuch money within 24 hours, ſhall be deemed as duly liſted, as if they had aſſented thereto before the proper magiſtrate; and they ſhall, in that caſe, be obliged to take the oath, or, upon refuſal, they ſhall be confined by the officer who liſted them, 'till they do take it.

Perſons, owning before the proper magiſtrate, that they voluntarily liſted themſelves, are obliged to take the oath, or ſuffer confinement by the officer who liſted them, 'till they do take it.

The magiſtrate is obliged, in both caſes, to certify, that ſuch perſons are duly liſted; ſetting forth their birth, age, and calling, if known; and that the ſecond and ſixth ſections of the articles of war againſt mutiny and deſertion were read to them, and that they had taken the oath.

Officers offending herein are to be caſhiered, and diſplaced from their office; to be diſabled from holding any poſt, civil or military; and to forfeit 100l.

Perſons receiving inliſting-money from any officer, knowing him to be ſuch, and afterwards abſconding, and refuſing to go before a magiſtrate to declare their aſſent or diſſent, are deemed to be inliſted to all intents and purpoſes, and may be proceeded againſt as if they had taken the oath.

LIEZIERE. See BERM. See FORTIFICATION.

LOCHABER-

LOCHABER-AX, a tremendous Scotch weapon, now used by none but the town-guard of Edinburgh; one of which is to be seen among the small armory in the Tower of London.

LOCKS, in *gunnery*, are of various sorts; common for lockers in travelling-carriages, or for boxes containing shot, powder, or cartridges. Also locks for fire arms.

To LOCK, in a *military sense*, is to fasten one or more of the wheels from going round, in going down a hill, &c.

LOCKER-*hinges*, serve to fasten the cover of the lockers in travelling-carriages.

LOCKING-*plates*, in *artillery*, are thin flat pieces of iron nailed on the sides of a field-carriage, where the wheels touch it in turning, to prevent the wearing the wood in those places. See CARRIAGE.

LOCKSPIT, in *field-fortification*, a small cut or trench made with a spade, about a foot wide, to mark out the first lines of a work.

LODGEMENT, in *military business*, is a work made by the besiegers in some part of a fortification, after the besieged have been drove out, to maintain it, and to be covered from the enemy's fire.

When a *lodgement* is to be made on the glacis, covert-way, or in a breach, there must be a great provision made of fascines, sand-bags, gabions, wool-packs, &c. in the trenches; and, during the action, the pioneers (under the direction of an engineer) with fascines, sand-bags, &c. should be making the lodgement, in order to form a covering, while the grenadiers are storming the covert-way, &c.

LONGIMETRY, the art of measuring lengths, accessible and inaccessible.

LONGITUDE *of the earth*, denotes its extent from west to east, according to the direction of the equator.

LONGITUDE *of a place*, in *geography*, its distance from some first meridian, or an arch of the equator intercepted between the meridian of the place, and the first meridian. See GEOGRAPHY.

LONGITUDE *of motion*, according to some philosophers, is the distance which the centre of any moving body runs through, as it moves on in a right line. See MOTION.

LOOP, in a *ship-carriage*, made of iron, fastened one on the front of a fore axle-tree, and two on each side, through which the ropes or tackle pass, whereby the guns are moved backwards and forwards on board of ships.

LOOP-*holes*, in old forts, &c. are square or oblong holes made in the wall to fire through with small arms.

LOUIS, *or Knight of St. Louis*, the name of a military order in France, instituted by Louis XIV. in 1693. Their collars are of a flame-colour, and pass from left to right: the king is always grand master.

LUNETTES, in *fortification*, are works made on both sides of the ravelin: one of their faces is perpendicular to half or two thirds of the faces of the ravelin; and the other nearly so to those of the bastions.

LUNETTES, are also works made beyond the second ditch, opposite to the places of arms: they differ from the ravelins only in their situation. See FORTIFICATION.

LUNETTONS, are a smaller sort of *lunettes*.

LYCANIENS. See PANDOURS.

M

MACHICOULIS, is an old word, sometimes applied to projections in old castles, and over gates of towns, left open above, to throw down stones, &c. on the approaching enemy.

MACHINE, in *general*, whatever hath force sufficient to raise or stop the motion of a heavy body.

MACHINES, are either simple or compound: the simple ones are the 7 mechanical powers, viz. lever, balance, pully, axis and wheel, screw, and inclined plane. See MECHANICAL POWERS.

If the given power is not able to overcome the given resistance when directly applied, that is, when the power applied is less than the weight or resistance given; then the thing is to be performed by the help of a *machine* made with levers, wheels, pullies, screws, &c. so adjusted, that when the weight and power are put in motion on the *machine*, the velocity of the power may be at least so much greater than that of the weight, as the weight and friction of the *machine*, taken together, is greater than the power; for on this principle depends the mechanism or contrivance of all mechanical engines;

gines used to draw or raise heavy bodies, or overcome any other force; the whole design of these being to give such a velocity to the power, in respect of the weight, as that the momentum of the power may exceed the momentum of the weight: for if *machines* are so contrived, that the velocity of the agent and resistant are reciprocally as their forces, the agent will just sustain the resistant, but with a greater degree of velocity will overcome it. So that if the excess of motion or velocity in the power is so great as to overcome all that resistance which commonly arises from the friction or attrition of contiguous bodies, as they slide by one another, or from the cohesion of bodies that are to be separated, or from the weights of bodies that are to be raised; the excess of the force remaining, after all these resistances are overcome, will produce an acceleration of motion thereto, as well in the parts of the *machine*, as in the resisting body.

Compound MACHINES, are formed by various combinations, and serve for different purposes; in all which the same general law takes place, viz. that the power and weight sustain each other, when they are in the inverse proportion of the velocities they would have in the directions wherein they act, if they were put in motion. Now, to apply this law to any compound *machine*, there are four things to be considered: 1. The moving power, or the force that puts the *machine* in motion; which may be either men or other animals, weights, springs, the wind, a stream of water, &c. 2. The velocity of this power, or the space it moves over in a given time. 3. The resistance, or quantity of weight to be removed. 4. The velocity of this weight, or the space it moves over in the same given time.

The two first of these quantities are always in the reciprocal proportion of the two last; that is, the product of the first two must always be equal to that of the last: hence, three of these quantities being given, it is easy to find the fourth; for example, if the quantity of the power be 4, its velocity 15, and the velocity of the weight 2, then the resistance, or quantity of the weight, will be equal to $\frac{4\times 15}{2} = \frac{60}{2} = 30$.

The following rules will direct the mechanic how he may contrive his *machine*, that it may answer the intended purpose, to the best advantage.

1. Having assigned the proportion of your power, and the weight to be raised, the next thing is to consider how to combine levers, wheels, pullies, &c. so that, working together, they may be able to give a velocity to the power, which shall be to that of the weight something greater than in the proportion of the weight to the power. This done, you must estimate your quantity of friction; and if the velocity of the power be to that of the weight still in a greater proportion than the weight and friction taken together are to the power; then your *machine* will be able to raise the weight. And note, this proportion must be so much greater, as you would have your engine work faster.

2. But the proportion of the velocity of the power and weight must not be made too great: for it is a fault to give a *machine* too much power, as well as too little: for if the power can raise the weight and overcome the resistance, and the engine perform its proper effect in a convenient time, and work well, it is sufficient for the end proposed: and it is in vain to make additions to the engine to increase the power any farther; for that would not only be a needless expence, but the engine would lose time in working.

3. As to the power applied to work the engine, it may be either a living power, as men, horses, &c. or an artificial power, as a spring, &c. or a natural power, as wind, water, fire, weights, &c.

When the quantity of the power is known, it matters not, as to the effect, what kind of power it is; for the same quantity of any sort will produce the same effect; and different sorts of powers may be applied in an equal quantity a great variety of ways.

The most easy power applied to a *machine* is weight, if it be capable of effecting the thing designed. If not, then wind, water, &c. if that can be conveniently had, and without much expence.

A spring is also a convenient moving power for several *machines*: but it never acts equally as the weight does; but is stronger when much bent, than when but a little bent, and that in proportion to the bending, or the distance it is forced to: but springs grow weaker by often bending, or remaining long bent; yet they recover part of their strength by lying unbent.

The natural powers, wind and water, may be applied to vast advantage in working of great engines, when managed with great skill and judgement. The due application of these has much abridged the labours of men; for

there is ſcarce any labour to be performed, but an ingenious artificer can tell how to apply theſe powers to execute his deſign, and anſwer his purpoſe; for any conſtant motion being given, it may, by due application, be made to produce any other motions we deſire. Therefore theſe powers are the moſt eaſy and uſeful, and of the greateſt benefit to mankind. Beſides, they coſt nothing, nor require any repetition or renewing, like a weight or a ſpring, which require to be wound up. When theſe cannot be had, or cannot ſerve our end, we have recourſe to ſome living power, as men, horſes, &c.

4. Men may apply their ſtrength ſeveral ways in working a *machine*. A man of ordinary ſtrength, turning a roller by the handle, can act for a whole day againſt a reſiſtance equal to 30 pounds weight; and if he works 10 hours in a day, he will raiſe a weight 30lb. 3½ feet in a ſecond; or if the weight be greater, he will raiſe it ſo much leſs in proportion.

But a man may act, for a ſmall time, againſt a reſiſtance of 50lb. or more.

If two men work at a windlaſs or roller, they can more eaſily draw up 70lb. than one man 30lb. provided the elbow of one of the handles be at right angles to that of the other: and with a fly or heavy wheel applied to it, a man may do 1-3d part more work; and for a little while act with a force, or overcome a continual reſiſtance of 80lb. and work a whole day when the reſiſtance is but 40lb.

Men uſed to carrying, ſuch as porters, will carry ſome 150lb. others 200lb. or 250lb. according to their ſtrength.

A man can draw but about 70 or 80lb. horizontally; for he can but apply half his weight.

If the weight of a man be 140lb. he can act with no greater force in thruſting horizontally, at the height of his ſhoulders, than 27lb.

A horſe draws to greateſt advantage, when the line of direction is a little elevated above the horizon, and the power acts againſt his breaſt; and can draw 200lb. for eight hours in a day, at two miles and a half an hour. If he draws 240lb. he can work but 6 hours, and not quite ſo faſt; and, in both caſes, if he carries ſome weight, he will draw better than if he carried none. And this is the weight a horſe is ſuppoſed to be able to draw over a pully out of a well. In a cart a horſe may draw 1000lb. The moſt force a horſe can exert is when he draws ſomething above a horizontal poſition.

The worſt way of applying the ſtrength of a horſe, is to make him draw or carry up a hill: and three men with 100lb. on their backs, will climb up a ſteep hill faſter than a horſe with 300lb.

A round walk for a horſe to draw in, at a mill, &c. ſhould not be leſs than 40 feet diameter.

5. Every machine ſhould be made of as few parts, and thoſe as ſimple, as poſſible, to anſwer its purpoſe; not only becauſe the expence of making and repairing will be leſs, but it will alſo be leſs liable to any diſorder: and it is needleſs to do a thing with many, which may be done with fewer parts.

6. If a weight is to be raiſed but a very little way, the lever is the moſt ſimple, eaſy, and ready machine; or, if the weight be very great, the common ſcrew is moſt proper: but if the weight is to be raiſed a great way, the wheel and axle is a proper power, and blocks and pullies are eaſier ſtill; and the ſame may be done by the perpetual ſcrew.

Great wheels, to be wrought by men or cattle, are of moſt uſe and convenience, when their axles are perpendicular to the horizon; but if by water, &c. then it is beſt to have their axles horizontal.

7. As to the combination of ſimple *machines* together, to make a compound one, though the lever when ſimple cannot raiſe a weight to any great height, and in this caſe is but of little ſervice; yet it is of great uſe when compounded with others. Thus the ſpokes of a great wheel are all levers perpetually acting; and a beam fixed to the axis to draw the wheel about by men or horſes, is a lever. The lever alſo may be combined with the ſcrew, but not conveniently with pullies, or with the wedge. The wheel and axle is combined with great advantage with pullies; but the perpetual ſcrew combined with the wheel is very ſerviceable. The wedge cannot be combined with any other mechanical power; and it only performs its effect by percuſſion; but this force of percuſſion may be increaſed by engines.

Pullies may be combined with pullies, and wheels with wheels. Therefore if any ſingle wheel would be too large, and take up too much room, it may be divided into 2 or 3 more wheels and trundles, or wheels and pinions, as in clock-work, ſo as to have the ſame power, and perform the ſame effect.

In wheels with teeth, the number of teeth that play together in 2 wheels, ſhould be prime to each other, that the ſame teeth may not meet at every revolution; for when different

teeth meet, they by degrees wear themſelves into a proper figure: therefore they ſhould ſo be contrived that the ſame teeth meet as ſeldom as poſſible.

8. The ſtrength of every part of the *machine* ſhould be made proportional to the ſtreſs it is to bear: and therefore let every lever be made ſo much ſtronger, as its length and the weight it is to ſupport are greater; and let its ſtrength diminiſh proportionally from the fulcrum, or point where the greateſt ſtreſs is to each end. The axles of wheels and pullies muſt be ſo much ſtronger as they are to bear greater weight. The teeth of wheels, and the wheels themſelves, which act with greater force, muſt be proportionally ſtronger; and in any combination of wheels and axles, make their ſtrength diminiſh gradually from the weight to the power, ſo that the ſtrength of every part be reciprocally as the velocity it has. The ſtrength of ropes muſt be according to their tenſion, and that is as the ſquares of their diameters: and, in general, whatever parts a *machine* is compoſed of, the ſtrength of every particular part of it muſt be adjuſted to the ſtreſs upon it; therefore in ſquare beams the cubes of the diameters muſt be made proportional to the ſtreſs they bear: and let no part be ſtronger or bigger than is neceſſary for the ſtreſs upon it; not only for the eaſe and well going of the *machine*, but for diminiſhing of the friction; for all ſuperfluous matter in any part of it, is nothing but a dead weight upon the machine, and ſerves for nothing but to clog its motion; and he is by no means a perfect mechanic, that does only adjuſt the ſtrength to the ſtreſs, but who alſo contrives all the parts to laſt equally well, that the whole *machine* may fall together.

9. To have the friction as little as poſſible, the *machine* ſhould be made of the feweſt and ſimpleſt parts. The diameters of the wheels and pullies ſhould be large, and the diameters of the arbors or ſpindles they run on, as ſmall as can be conſiſtent with their ſtrength. All ropes and cords muſt be as pliable as poſſible, and for that end rubbed with tar or greaſe: the teeth of wheels muſt be made to fit and fill up the openings, and cut into the form of epicycloids. All the axles, where the motion is, and all teeth where they work, and all parts that in working rub upon one another, muſt be made ſmooth; and when the machine goes, muſt be oiled or greaſed.

10. When any motion is to be long continued, contrive the power to move or act always one way, if it can be done; for this is better and eaſier performed than when the motion is interrupted, and the power is forced to move firſt one way, and then another; becauſe every change of motion requires a new additional force to effect it. Beſides, a body in motion cannot ſuddenly receive a contrary motion, without great violence: and the moving any part of the *machine* contrary ways by turns, with ſudden jerks, tends only to ſhake the *machine* to pieces.

11. In a *machine* that moves always one way, endeavour to have the motion uniform.

12. But when the nature of the thing requires that a motion is to be ſuddenly communicated to a body, or ſuddenly ſtopped: to prevent any damage or violence to the engine by a ſudden jolt, let the force act againſt ſome ſpring, or beam of wood, which may ſupply the place of a ſpring.

13. In regard to the ſize of the *machine*, let it be made as large as it can conveniently. The greater the *machine*, the exacter it will work, and perform all its motions the better; for there will always be ſome errors in the making, as well as in the materials, and conſequently in the working of the *machine*. The reſiſtance of the medium in ſome *machines* has a ſenſible effect: but all theſe mechanical errors bear a leſs proportion to the motion of the *machine* in great machines than in little ones; being nearly reciprocally as their diameters, ſuppoſing they are made of the ſame matter, and with the ſame accuracy, and are equally well finiſhed: therefore in a ſmall *machine* they are more ſenſible, but in a great one almoſt vaniſh; therefore great *machines* will anſwer better than ſmall ones, in all reſpects, except in ſtrength; for the greater the *machine*, the weaker it is, and leſs able to reſiſt any violence.

14. For engines that go by water, it is neceſſary to meaſure the velocity and force of the water. To get the velocity, drop in pieces of ſticks, &c. and obſerve how far they are carried in a ſecond, or any given time.

But if it flows through a hole in a reſervoir, or ſtanding receptacle of water, the velocity will be found from the depth of the whole below the ſurface.

Thus let $s = 16\frac{1}{12}$ feet; $v =$ velocity of the fluid per ſecond; $B =$ the area of the hole; $H =$ the height of the water; all in feet. Then the velocity $v = \sqrt{2sH}$; and its force $=$ the weight of the quantity $\frac{vv}{2s}B$ or HB of water, or $= \frac{62\frac{1}{2}}{112}HB$ hundred weight: be-

cauſe

caufe a cubic foot=62½ lb. avoirdup. Alfo a hogfhead is about 8½ feet, or 531 lb. and a tun is 4 hogfheads.

When you have but a fmall quantity of water, you muft contrive it to fall as high as you can, to have the greater velocity, and confequently more force upon the engine.

15. If water is to be conveyed through pipes to a great diftance, and the defcent be but fmall, much larger pipes muft be ufed, becaufe the water will come flow.

Water fhould not be driven through pipes fafter than 4 feet per fecond, by reafon of the friction of the tubes; nor fhould it be too much wire-drawn, that is, fqueezed through fmaller pipes, for that creates a refiftance, as water-way is lefs in narrow pipes.

16. When any thing is to be performed by a water-wheel, moved by the water running under it and ftriking the paddles or ladle-boards, the channel it moves in ought to be fomething wider than the hole of the adjutage, and fo clofe to the floats on every fide as to let little or no water pafs; and when paft the wheel, to open a little, that the water may fpread. It is of no advantage to have a great number of floats or paddles; for thofe paft the perpendicular are refifted by the back-water, and thofe before it are ftruck obliquely. The greateft effect that fuch a wheel can perform, in communicating any motion, is when the paddles of the wheel move with ⅓ the velocity of the water, in which cafe, the force upon the paddle is $\frac{4}{9}$ only; fuppofing the abfolute force of the water againft the paddle, when the wheel ftands ftill, to be 1: fo that the utmoft motion which the wheel can generate, is but $\frac{4}{27}$ of that which the force of the water againft the paddles at reft would produce. This is when the wheel is at the beft; but fometimes far lefs is done.

There is ftill another fpecies of *machine*, which acts by a diftinct power, the compreffion and expanfion of air; invented and brought to perfection by the ingenious Mr. Blakey, who has obtained his majefty's patent for fecuring to himfelf the advantages that may refult from their ufe.

MADRIERS, in the *military art*, are long planks of broad wood, ufed for fupporting the earth in mining, carrying on a fap, making coffers, caponiers, galleries, and various other purpofes at a fiege; alfo to cover the mouth of petards after they are loaded, and are fixed with the petards to the gates or other places defigned to be forced open. When the planks are not ftrong enough, they are doubled with plates of iron.

MAGAZINE, a place in which ftores are kept, or arms, ammunition, provifions, &c. Every fortified town ought to be furnifhed with a large magazine, which fhould contain ftores of all kinds, fufficient to enable the garrifon and inhabitants to hold out a long fiege, and in which fmiths, carpenters, wheel-wrights, bakers, &c. may be employed in making every thing belonging to the artillery, as carriages, waggons, &c.

Powder-MAGAZINE, is that place where the powder is kept in very large quantities. Authors differ greatly both in regard to fituation and conftruction; but all agree, that they ought to be arched, and bomb-proof. In fortifications they are frequently placed in the rampart; but of late, they have been built in different parts of the town. The firft powder-magazines were made with Gothic arches; but M. Vauban, finding them too weak, conftructed them in a femicircular form, whofe dimenfions are, 60 feet long, within; 25 broad; the foundations are 8 or 9 feet thick, and 8 feet high from the foundation to the fpring of the arch; the floor is 2 feet from the ground, which keeps it from dampnefs.

One of our engineers of great experience fome time fince had obferved, that after the centres of femicircular arches are ftruck, they fettle at the crown and rife up at the hances, even with a ftraight horizontal extrados, and ftill much more fo in powder-magazines, whofe outfide at top is formed like the roof of a houfe, by two inclined planes joining in an angle over the top of the arch, to give a proper defcent to the rain; which effects are exactly what might be expected agreeable to the true theory of arches. Now, as this fhrinking of the arches, muft be attended with very ill confequences, by breaking the texture of the cement after it has been in fome degree dried, and alfo by opening the joints of the vouffoirs at one end, fo a remedy is provided for this inconvenience, with regard to bridges, by the *arch of equilibration* in Mr. Hutton's book on bridges; but, as the ill effect is much greater in powder-magazines, the fame ingenious gentleman propofed to find an arch of equilibration for them alfo, and to conftruct it when the fpan is 20 feet, the pitch or height 10, (which are the fame dimenfions as the femicircle) the inclined exterior walls at top form-

ing.

ing an angle of 113 degrees, and the height of their angular point above the top of the arch, equal to 7 feet: this very curious question was answered in 1775 by the Rev. Mr. Wildbore, to be found in Mr. Hutton's *Miscellanea Mathematica*, See Plate III. fig. 3.

He supposes D and C to be two points in the required arch, and that D is a given one. Draw the tangents Dg, Cg, and the vertical line Hg through their intersection till it meets the roof IK in H: then, in order that the wall $ICDK$ may rest in equilibrio on the arch CD, it is necessary that its centre of gravity be in the line Hg: let Cb be an indefinitely small part of the tangent Cg, or the fluxion of the arch CD; draw bb parallel to FK, or AB, and bq to Dg; then, in order that the wall may be supported in equilibrio by two forces in the directions Cb, Dg, these forces, and the gravity of the wall, must be as the three sides Cb, qb, and qC of the triangle qCb parallel to those forces. This premised, let $FK=x$, $FC=y$, $CI=u$, $bC=\dot{y}$, $bb=\dot{x}$, $c=$ the tangent of $FKI=30°, 30'$, $FI=cx$, $DG=m$, $KG=q$, (gD being continued to G); bq (by sim. △ s) $=\frac{n\dot{x}}{q}$, $Cq=\dot{y}-\frac{n\dot{x}}{q}$, $bq=\frac{m\dot{x}}{q}$, the constant force acting at D along the curve $=a$, and the wall or area $ICDK=p$; then, from what is premised, as $a:p::\frac{m\dot{x}}{q}:\dot{y}-\frac{n\dot{x}}{q}$, or $mp\dot{x}=qa\dot{y}-na\dot{x}$; or making $\dot{x}$ constant, $qa\ddot{y}=m\dot{p}\dot{x}$. Now the area of the △ $FIK=\frac{cx^2}{2}$, its fluxion $=cx\dot{x}$, and consequently $\dot{p}=y\dot{x}-cx\dot{x}$, which being substituted for $\dot{p}$ in the last equation, gives $qa\ddot{y}=my\dot{x}^2-mcx\dot{x}^2$, or putting $\frac{qa}{m}=Q$, $\frac{Q\ddot{y}}{\dot{x}^2}=y-cx=CI=u$; ∵ $\dot{y}-c\dot{x}=\dot{u}$, $\ddot{y}=\ddot{u}$, $\frac{Q\ddot{y}}{\dot{x}^2}=\frac{Q\ddot{u}}{\dot{x}^2}=u$, $\frac{2Q\dot{u}\ddot{u}}{\dot{x}^2}$, and (taking the fluents) $\frac{Q\dot{u}^2}{\dot{x}^2}=u^2$: but since u and $\dot{u}$ do not begin together $\frac{Q\dot{u}^2}{\dot{x}^2}=u^2-d^2$, where $d=$ the value of u at the vertex of the curve $=7$; consequently $\dot{x}=\frac{Q^{\frac{1}{2}}\dot{u}}{\sqrt{u^2-d^2}}$, and (again taking the correct fluents) $x=Q^{\frac{1}{2}}\times$ hyp. log. of $\frac{u+\sqrt{u^2-d^2}}{d}$. Now, if we suppose D to be the vertex of the arch LA (the greatest value of u) $=b$, and AQ (the greatest value of x) $=g$, we obtain $Q^{\frac{1}{2}}=\frac{g}{\text{hyp. log.}\frac{b+\sqrt{b^2-d^2}}{d}}$ which being known, the curve may be readily constructed from the above equation, or from the following, viz. $u=\frac{M^2+d^2}{2M}$, where $M=\frac{x}{dN\sqrt{Q}}$ and $N=2.71828$.

Corol. 1. Since at D the vertex, $FC=IC$, gD the tangent to the curve there must be parallel to LK, and consequently the angle at the key-stone of the arch $=$ that of the roof.

Corol. 2. If the ∠ IKD be right, $c=0$, $u=y$, and $x=Q^{\frac{1}{2}}\times$ hyp. log. $\frac{y+\sqrt{y^2-d^2}}{d}$; which being the same case, is likewise the same conclusion as that derived by a very different method, at page 40 of Mr. Hutton's *Principles of Bridges*.

Artillery-MAGAZINE, in a *siege*, the magazine is made about 25 or 30 yards behind the battery, towards the parallels, and at least 3 feet under ground, to hold the powder, loaded shells, portfires, &c. Its sides and roof must be well secured with boards, to prevent the earth from falling in: a door is made to it, and a double trench or passage is sunk from the magazine to the battery, one to go in and the other to come out at, to prevent confusion. Sometimes traverses are made in the passages to prevent ricochet shot from plunging into them. See Plate III.

MAGNITUDE, or *quantity*, any thing locally continued, or that has several dimensions. Its origin is a point, which though void of parts, yet its flux forms a line, the flux of that a surface, and of that a body, &c.

MAIN-BODY *of the army*, the body of troops that march between the advance and rear-guards. In *a camp*, that part of the army encamped between the right and left wings.

MAIN-GUARD, or *grand-guard*, a body of horse posted before a camp for the security of an army. In *garrison*, it is a guard generally mounted by a subaltern officer and about 24 men. See GUARD.

MAJOR, in the *art of war*, the name of several officers of very different ranks and functions.

MAJOR *of a regiment of foot*, the next officer to the lieutenant-colonel, generally promoted from the eldest captain: he is to take care that the regiment be well exercised, to see it march in good order, and to rally it in case of being broke in action: he is the only officer among the infantry that is allowed to be on horseback in time of action, that he may the more readily execute the colonel's orders.

MAJOR *of a regiment of horse*, as well as foot, ought to be a man of honour, integrity, understanding,

derstanding, courage, activity, experience, and address: he should be master of arithmetic, and keep a detail of the regiment in every particular: he should be skilled in horsemanship, and ever attentive to his business: one of his principal functions is, to keep an exact roster of the officers for duty: he should have a perfect knowledge in all the military evolutions, as he is obliged by his post to instruct others, &c.

Town-MAJOR, the third officer in order in a garrison, and next to the deputy-governor. He should understand fortification, and has a particular charge of the guards, rounds, patroles, and centinels.

Brigade-MAJOR, is a particular officer appointed for that purpose, only in camp: he goes every day to head-quarters to receive orders from the adjutant-general: there they write exactly whatever is dictated to them: from thence they go and give the orders, at the place appointed for that purpose, to the different majors or adjutants of the regiments which compose that brigade, and regulate with them the number of officers and men which each are to furnish for the duty of the army; taking care to keep an exact roster, that one may not give more than another, and that each march in their tour: in short, the major of brigade is charged with the particular detail in his own brigade, in much the same way as the adjutant-general is charged with the general detail of the duty of the army. He sends every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade missing at the retreat, or a report, expressing that none are absent: he also mentions the officers absent with or without leave.

As all orders pass through the hands of the majors of brigade, they have infinite occasions of making known their talents and exactness.

MAJOR *of artillery*, is also the next officer to the lieutenant-colonel. His post is very laborious, as the whole detail of the corps particularly rests with him; and for this reason all the non-commissioned officers are subordinate to him, as his title of serjeant-major imports: in this quality they must render him an exact account of every thing which comes to their knowledge, either regarding the duty or wants of the artillery and soldiers. He should possess a perfect knowledge of the power of artillery, together with all its evolutions. In the field he goes daily to receive orders from the brigade-major, and communicates them with the parole to his superiors, and then dictates them to the adjutant. He should be a very good mathematician, and be well acquainted with every thing belonging to the train of artillery, &c.

MAJOR *of engineers*, commonly with us called sub-directors, should be very well skilled in military architecture, fortification, gunnery, and mining. He should know how to fortify in the field, to attack and defend all sorts of posts, and to conduct the works in a siege, &c. See ENGINEER.

Aid-MAJOR, is on sundry occasions appointed to act as major, who has a pre-eminence above others of the same denomination. Our horse and foot-guards have their guidons, or second and third majors.

Serjeant-MAJOR, is a non-commissioned officer, of great merit and capacity, subordinate to the adjutant, as he is to the major. See SERJEANT.

Drum-MAJOR, is not only the first drummer in the regiment, but has the same authority over his drummers as the corporal has over his squad. He instructs them in their different beats; is daily at orders with the serjeants, to know the number of drummers for duty. He marches at their head when they beat in a body. In the day of battle, or at exercise, he must be very attentive to the orders given him, that he may regulate his beats according to the movements ordered.

Fife-MAJOR, is he that plays the best on that instrument, and has the same authority over the fifers as the drum-major has over the drummers. He teaches them their duty, and appoints them for guards, &c.

MALLEABLE, in the *art of founding*, a property of metals, whereby they are capable of being extended under the hammer.

MARTIOBARBULI, in *ancient military history*, a sort of loaded javelins, five of which each soldier carried in the concavity of his shield.

Knights of MALTA, otherwise called *Hospitalers of St. John of Jerusalem*, a religious military order, whose residence is in the island of Malta. The order consists of three estates, the knights, chaplains, and servants at arms: none are admitted into this order, but such as are of noble birth. They never marry, yet have continued from 1090 to the present time.

MANEGE, or *Manage*, in *horsemanship*, the exercise of riding the great horse, or the ground set apart for that purpose; which is sometimes covered, for continuing the exercise in bad weather; and sometimes open, in order to give more liberty and freedom both to the horseman and horse.

MANIFESTO, in *military hiſtory*, a public declaration made by a prince in writing, ſhowing his intentions to begin a war, or rather enterpriſe, with the motives that induce him to it, and the reaſons on which he founds his rights and pretenſions.

MANIPULUS, in *ancient military hiſtory*, a body of Roman infantry, conſiſting of 200 men, and conſtituting the third part of a cohort.

MANŒUVRE, in a *military ſenſe*, conſiſts ſolely in diſtributing equal motion to every part of a body of troops, to enable the whole to form, or change their poſition, in the moſt expeditious and beſt method, to anſwer the purpoſes required of a battalion, brigade, or line of cavalry, infantry, or artillery. It has always been lamented, that men have been brought on ſervice without being informed of the uſes of the different manœuvres they have been practiſing; and having no ideas of any thing but the uniformity of the parade, inſtantly fall into diſorder and confuſion when they loſe the ſtep, or ſee a deviation from the ſtraight lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention confined to ſhow, and ſo little given to inſtruct the troops in what may be of uſe to them on real ſervice.

No manœuvre ſhould be executed in the preſence of the enemy, unleſs protected by ſome diviſion of the troops.

MANTELETS, in a *military ſenſe*, are either ſingle or double, compoſed of great planks of wood, of about 5 feet high, and 3 inches thick. The ſingle ones are ſometimes covered with tin, made muſket-proof, which the pioneers generally roll before them, being fixed upon wheels, to cover them from the enemy's fire, in opening the trenches, or carrying on the ſap, &c. The double ones form an angle, and ſtand ſquare, making two fronts, which cover both the front and flank of the ſappers, &c. when at work: theſe have double planks, with earth rammed in between them: they are 5 feet high, and 3 in breadth, ſometimes covered with plates of iron. They may with propriety be called a moving parapet, having a ſhaft to guide them by.

MAP, in a *military and geographical ſenſe*, is a plane figure, repreſenting the ſurface of the earth, or a part thereof, according to the laws of perſpective; diſtinguiſhing the ſituation of cities, mountains, rivers, roads, &c.

In maps theſe three things are eſſentially neceſſary. 1. That all places have the ſame ſituation and diſtance from the great circles therein, as on the globe, to ſhow their parallels, longitudes, zones, climates, and celeſtial appearances. 2. That their magnitudes be proportionable to the real magnitudes on the globes. 3. That all places have the ſame ſituation, bearing, and diſtance, as on the earth itſelf.

MAPS are either univerſal, which exhibit the whole ſurface of the earth; or partial, which exhibit ſome particular part thereof: each kind is called geographical or land-maps, in contradiſtinction to hydrographical or ſea-maps, repreſenting the ſeas and ſea-coaſts, properly called charts.

As a *map* is a repreſentation of ſome part of the ſurface of the earth delineated upon a plane; the earth being round, no part of the ſpherical ſurface of it can be accurately exhibited upon a plane; and therefore ſome have propoſed the making of globular *maps*. For this purpoſe a plate of braſs might be hammered, or at a leſs expence a piece of paſte-board might be formed into a ſegment of a ſphere, and covered on its convex ſide with a *map* projected in the ſame manner as the papers of the common globe are. A *map* made in this method would ſhow every thing in the ſame manner, as it would be ſeen upon a globe of the ſame diameter with the ſphere upon the ſegment of which it was delineated: and, indeed, maps of this ſort would in effect be ſegments of ſuch a globe; but they are not in common uſe.

The ancients deſcribed all parts of the known earth in one general *map*. In this view one of them compares the ſhape of the earth to the leather of a ſling, whoſe length exceeds its breadth: the length of the then known parts of the earth from eaſt to weſt was conſiderably greater, than from north to ſouth; for which reaſon, the former of theſe was called the longitude, and the other the latitude.

The modern general *maps* are ſuch as give us a view of an entire hemiſphere, or half of the globe; and are projected upon the plane of ſome great circle, which terminates the projected hemiſphere, and divides it from the other half of the globe, as the equator, the meridian, or horizon of ſome place. From the circle the projection is denominated, and ſaid to be equatorial, meridional, or horizontal.

Particular *maps* are ſuch as exhibit to us leſs than an hemiſphere: of this ſort are *maps* of the great parts into which the earth is divided, as Europe, Aſia, Africa, and America; or *maps* of particular kingdoms, provinces, countries, or of leſſer diſtricts.

A particular *map* is a part of a general one, and may be made upon the ſame principles, as by

by projecting a large hemisphere, and taking so much of it as the *map* is designed to contain. When we are to delineate a *map* of the smaller part of the earth, if it be near the equator, the meridians and parallels may be represented by equi-distant straight lines. If at some distance from the equator, the parallels may be equi-distant straight lines, and the meridians straight lines, a little converging towards the nearest pole; or the meridians may be straight lines, converging towards the nearest pole, and the parallels circular.

When we are to make a *map* of a very small district, as of a county or hundred, whatever part of the earth it be in, the meridians and parallels may be equi-distant straight lines, drawn through every minute, &c. of longitude, according as the largeness of the *map* will allow. See PLOTTING and SURVEYING.

The use of *maps* is obvious from their construction. The degrees of the meridians and parallels shew the longitude and latitude of places; their bearings from each other appear from inspection; and their distances from each other may be measured by the divisions on the meridian, equator, or scales. See GEOGRAPHY.

MARAUDING, in a *military sense*, means a party of soldiers, who, without any order, go into the neighbouring houses or villages, when the army is either in camp or garrison, to plunder and destroy, &c. Marauders are a disgrace to the camp, to the military profession, and deserve no better quarters from their officers than they give to poor peasants, &c.

A MARCH, is the moving of a body of men from one place to another. Care must be taken, in marching of troops, that they are not liable to be flanked or intercepted; for of all operations none is more difficult, because they must not only be directed in the objects they have in view, but according to the movements the enemy may have made.

Of all the mechanical parts of war, none is more essential than that of marching. It may be justly called the key which leads to all sublime motions and manœuvres of an army; for they depend entirely on this point. A man can be attacked in four different ways; in the front, on both flanks, and in the rear: but he can defend himself, and annoy the enemy, only when placed with his face towards him. Hence it follows, that the general object of marching, is reduced to three points only; to march forwards, and on both sides, because it is impossible to do it for any time backwards, and by that means face the enemy wherever he presents himself. The different steps to be made use of are three; slow, fast, and oblique. The first is proper in advancing, when at a considerable distance from the enemy, and when the ground is unequal, that the line may not be broke, and a regular fire kept up without intermission. The second is chiefly necessary, when you want to anticipate the enemy in occupying some post, in passing a defile, and, above all, in attacking an intrenchment, to avoid being a long while exposed to the fire of the artillery and small-arms, &c. The third step is of infinite consequence, both in the infantry and cavalry: columns may be opened and formed into lines, and, *vice versa*, lines into columns, by this kind of step, in a lesser space, and consequently in less time, than by any other method whatsoever. In coming out of a defile, you may instantly form the line without presenting the flank to the enemy. The line may be formed, though ever so near to the enemy, with safety, because you face him, and can with ease and safety protect and cover the motion of the troops, while they are coming out of the defiles, and forming. The same thing may be equally executed, when a column is to be formed, in order to advance or retreat; which is a point of infinite consequence, and should be established as an axiom.

The order of *march* of the troops must be so disposed, that each should arrive at their rendezvous, if possible, on the same day. The quarter-master-general, or his deputy, with an able engineer, should sufficiently reconnoitre the country, to obtain a perfect knowledge of it and the enemy, before he forms his routes.

Before a *march*, the army generally receives several days bread. The quarter-masters, camp-colour-men, and pioneers, parade according to orders, and march immediately after, commanded by the quarter-master-general, or his deputy. They are to clear the roads, level the ways, make preparations for the march of the army, &c. The *general*, for instance, beats at 2, the *assembly* at 3, and the army to march in 20 minutes after. Upon beating the *general*, the village, and general officer's guards, quarter and rear guards, join their respective corps; and the army pack up their baggage. Upon beating the *assembly*, the tents are to be struck, and sent with the baggage to the place appointed, &c.

The companies draw up in their several streets, and the rolls are called. At the time appointed, the drummers are to beat a march, and fifers play at the head of the line; upon which

which the companies *march* out from their ſeveral ſtreets, form battalions as they advance to the head of the line, and then halt.

The ſeveral battalions will be formed into columns by the adjutant-general, and the order of march, &c. be given to the general officers who lead the columns.

The cavalry generally march by regiments or ſquadrons. The heavy artillery always keeps the great roads, in the centre of the columns, eſcorted by a ſtrong party of infantry and cavalry. The field-pieces march with the columns.

Each ſoldier generally marches with 36 rounds of powder and ball, and 2 good flints; one of which is to be fixed in the cock of his firelock. The routes muſt be formed, ſo that no columns croſs another on the march.

MARQUE, or *Letters of Marque*, in *military affairs*, are letters of repriſal, granting the ſubjects of one prince or ſtate liberty to make repriſals on thoſe of another. See LETTERS *of* MARQUE.

MARINE, implies, in general, the whole navy of a kingdom or ſtate, comprehending all the royal dock-yards, and the officers, artificers, ſeamen, ſoldiers, &c. employed therein, as well as the ſhipping employed by the merchants for military or commercial purpoſes; together with whatever relates to navigation, ſhip building, ſailors, and marines.

The hiſtory of the marine affairs of any one ſtate is a very comprehenſive ſubject; much more that of all nations. Not only the preſervation of that ſhare of commerce we at preſent poſſeſs, but its future advancement, and even the very being of Britain, as an independent empire, and a free people, depend no leſs on the good condition and the wiſe regulation of our affairs of the marine, than on the ſuperiority of its naval power. The Delphian oracle being conſulted by the Athenians, on the formidable armament and innumerable forces of Xerxes, returned for anſwer, "that they muſt ſeek their ſafety in "wooden walls." To which we may affirm, that whenever this nation in particular has recourſe to her floating bulwarks for her ſecurity and defence, ſhe will find ſtrength, wealth, and glory, to be the happy and infallible conſequence.

MARINE *forces*, MARINES, } a body of ſoldiers, raiſed for the ſea-ſervice, and trained to fight either in a naval engagement, or in an action on ſhore. They are under the direction of the lords of the admiralty. The marine forces of Great-Britain, in time of peace, are ſtationed in 3 diviſions, one of which is quartered at Chatham, one at Portſmouth, and another at Plymouth; that is, 16 companies at Chatham, 27 at Portſmouth, and 27 at Plymouth; making in all 70 companies.

MARLIN, in *artillery*, are tarred white ſkains or long wreaths or lines of untwiſted hemp, dipped in pitch or tar, with which cables and other ropes are wrapped round, to prevent their fretting or rubbing in the blocks or pullies through which they paſs. The ſame ſerves in artillery upon ropes uſed for rigging gins, uſually put up in ſmall parcels called ſkains.

MARSHAL, *Field*-MARSHAL, } in its primitive ſignification, means an officer who has the care and charge of horſes; but it is now applied to officers who have very different employments. In a military ſenſe, it means the commander in chief of all the forces. See GENERAL.

MARSHAL *of France*, an officer of the greateſt dignity in the French army. It was firſt eſtabliſhed by Philip-Auguſt, in the year 1185.

MARSHAL *de camp*. See MAJOR-GENERAL.

MARTIAL-*Law*, is the law of war, which entirely depends on the arbitrary power of the prince, or of thoſe to whom he has delegated it; for, though the king can make no laws in time of peace without the conſent of parliament, yet in time of war he uſes an abſolute power over the army.

MASTER *at arms*, in the *marine*, an officer appointed to teach the officers and crew of a ſhip of war the exerciſe of the ſmall-arms; to confine, and plant centinels over, the priſoners, and ſuperintend whatever relates to them during their confinement. He is alſo to obſerve that the fire and lights are all extinguiſhed as ſoon as the evening-gun is fired, except thoſe that are permitted by proper authority, or under the inſpection of centinels. It is likewiſe his duty to attend the gang-way, when any boats arrive aboard, and ſearch them carefully, together with their rowers, that no ſpirituous liquors may be conveyed into the ſhip, unleſs by permiſſion of the commanding officer. In theſe ſeveral duties he is aſſiſted with proper attendants, called his corporals, who alſo relieve the centinels, and one another, at certain periods.

MASTER *gunner*, in a *ſhip of war*, an officer appointed to take charge of the artillery and ammunition aboard, and to teach the men the exerciſe of the great guns.

MASTER *of the horſe*, a great officer of the crown, who orders all matters relating to the king's ſtables, races, breed of horſes; and commands

mands the equerries and all the other officers and tradesmen in the king's stables. His coaches, horses, and attendants, are the king's, and bear the king's arms and livery.

MASTER-*general of the ordnance*. See ORDNANCE.

MATCH, in *artillery*, a kind of rope slightly twisted, and prepared to retain fire for the uses of the artillery, mines, fire-works, &c. It is made of hempen tow, spun on the wheel like cord, but very slack; and is composed of three twists, which are afterwards again covered with tow, so that the twists do not appear: lastly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually, without ever going out, 'till the whole be consumed. It is mounted on a lint-stock.

Quick MATCH, used in *artillery*, made of three cotton strands drawn into lengths, and put into a kettle just covered with white wine vinegar, and then a quantity of saltpetre and mealed powder is put in it, and boiled 'till well mixed. Others put only saltpetre into water, and after that take it out hot, and lay it into a trough with some mealed powder, moistened with some spirits of wine, thoroughly wrought into the cotton by rolling it backwards and forwards with the hands; and when this is done, they are taken out separately, drawn through mealed powder, and dried upon a line. See LABORATORY.

MATHEMATICS, from μαθησις, originally signified any disciple of learning; but, at present, denotes that science which teaches, or contemplates, whatever is capable of being numbered or measured, in so far as being computable or measurable; and accordingly is subdivided into arithmetic, which has numbers for its object, and geometry, which treats of magnitude.

MATHEMATICS are commonly distinguished into pure and speculative, which consider quantity abstractedly; and mixed, which treat of magnitude as subsisting in material bodies, and consequently are interwoven every where with physical considerations.

Mixed MATHEMATICS are very comprehensive, since to them may be referred astronomy, optics, geography, hydrography, hydrostatics, mechanics, fortification, gunnery, projectiles, mining, engineering, and navigation.

Pure mathematics have one peculiar advantage, that they occasion no disputes among wrangling disputants, as in other branches of knowledge; and the reason is, because the definitions of the terms are premised, and every one that reads a proposition has the same idea of every part of it. Hence it is easy to put an end to all mathematical controversies, by showing, that our adversary has not stuck to his definitions, or has not laid down true premises, or else that he has drawn false conclusions from true principles; and, in case we are able to do neither of these, we must acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reason mathematically upon physical subjects, we cannot give such just definitions as the geometricians: we must therefore rest content with descriptions; and they will be of the same use as definitions, provided we are consistent with ourselves, and always mean the same thing by these terms we have once explained.

Dr. Barrow gives a most elegant description of the exellence and usefulness of mathematical knowledge, in his inaugural oration, upon being appointed professor of mathematics at Cambridge.

The mathematics, he observes, effectually exercise, not vainly delude, nor vexatiously torment studious minds with obscure subtleties; but plainly demonstrate every thing within their reach, draw certain conclusions, instruct by profitable rules, and unfold pleasant questions. These disciplines likewise inure and corroborate the mind to constant diligence in study; they wholly deliver us from a credulous simplicity, most strongly fortify us against the vanity of scepticism, effectually restrain us from a rash presumption, most easily incline us to a due assent, perfectly subject us to the government of right reason. While the mind is abstracted and elevated from sensible matter, distinctly views pure forms, conceives the beauty of ideas, and investigates the harmony of proportions; the manners themselves are sensibly corrected and improved, the affections composed and rectified, the fancy calmed and settled, and the understanding raised and excited to more divine contemplations.

MATROSSES, are properly apprentices to the gunner, being soldiers in the royal regiment of artillery, and next to them: they assist in loading, firing, and spunging the great guns. They carry firelocks, and march along with the guns and store-waggons, both as a guard, and to give their assistance on every emergency.

MATTUCASHLASH, an ancient Scotch weapon, sometimes called arm-pit dagger, was worn there, ready to be used on coming to close quarters. This, with a pistol stuck in the the girdle, completely armed the highlanders.

MAXIMS,

MAXIMS, in *fortification*. See FORTIFICATION.

MEASURE, in *geometry*, any quantity assumed as one, to which the ratio of other homogeneous or similar quantities is expressed.

MEASURE *of an angle*, the length of an arch described from the vertex to any place between its legs: hence angles are distinguished by the ratio of the arches between the legs to the peripheries. See ANGLE.

MEASURE *of a figure*, is a square, whose side is an inch, foot, yard, or other determinate measure. Hence square measures.

Among geometricians it is usually a square rod called *decempeda*, divided into 10 square feet, and those into square digits, and those again into 10 lines, &c.

MEASURE *of a line*, any right line taken at pleasure, and considered as unity.

MEASURE *of the mass or quantity of matter*, in *mechanics*, is its weight; it being apparent that all the matter which coheres with a body, gravitates with it; and it being found by experiment, that the gravities of homogeneal bodies are in proportion to their bulks: hence, while the mass continues the same, the absolute weight will be the same, whatever figure it puts on; for as to its specific weight, it varies as the quantity of its surface does.

MEASURE *of a number*, in *arithmetic*, such a number as divides another without leaving a fraction: thus 9 is a measure of 27.

MEASURE *of a solid*, is a cube, whose side is an inch, foot, yard, or other determinate length: in geometry, it is a cubic perch, divided into cubic feet, digits, &c. Hence cubic measure or measures of capacity.

MEASURE *of velocity*, in *projectiles* and *mechanics*, the space passed over by a moving body in any given time. The space therefore must be divided into as many equal parts, as the time is conceived to be divided into: the quantity of space answering to such an article of time, is the measure of the velocity.

Measures then are various, according to the different kinds and dimensions of things measured. Hence arise lineal and longitudinal measure for lines or lengths; square, for areas; and solid or cubic, for bodies and their capacities: all which again are very different in different countries and ages, and even many of them for different commodities. Hence also arise other divisions, of domestic and foreign, ancient and modern, dry and wet (or liquid) measures, &c.

Long MEASURE. The English standard long measure, or that whereby the quantities of things are ordinarily estimated, is the yard, containing 3 English feet, equal to 3 Paris feet 1 inch and 3-12ths of an inch, or 7-9ths of a Paris ell. Its subdivisions are the foot, span, palm, inch, and barley-corn: its multipliers are the pace, fathom, pole, furlong, and mile.

French standard MEASURE is the aune or ell, containing 3 Paris feet, 7 inches, 8 lines, or 1 yard 2-7ths English; the Paris foot royal exceeding the English by $\frac{68}{1000}$ parts: this ell is divided two ways; namely, into halves, thirds, sixths, and twelfths; and into quarters, half-quarters, and sixteenths. This ell obtains in the greatest part of France, excepting at Troyes, Ares, and some parts of Picardy and Burgundy, where the ell is no more than 2 feet, 5 inches, 1 line; and at St. Genoux, where it exceeds the Paris ell by 8 lines: but at Marseilles, Montpellier, Tholouse in Provence, and Guinne, it contains 5 Paris feet, 5 inches, and 6 lines, or a Paris ell and a half: at Montpellier and the lower Languedoc, in Provence, Avignon, and even Dauphiné, it is a Paris ell and two thirds.

The English foot, to the French royal, is as 107 to 114; and the French toise is equal to 6 feet English, nearly.

Standard MEASURE, in Holland, Flanders, Sweden, a good part of Germany, many of the Hans-towns, Dantzig, and Hambourg, and at Geneva, Frankfort, &c. is likewise the ell, being different in all these parts: in Holland it contains 1 Paris foot, 11 lines, and 4-7ths of the Paris ell: the Flanders ell contains 7-12ths of the Paris ell: the ell of Germany and Brabant, &c. is equal to that of Flanders.

Italian MEASURE, is the braccio, or fathom; which obtains in the states of Modena, Venice, Florence, Lucca, Milan, Mantua, Bologna, &c. At Venice it contains 1 Paris foot, 11 inches, 3 lines, or 8-15ths of the Paris ell: at Bologna, Modena, and Mantua, the same as at Venice: at Lucca it contains $\frac{1}{2}$ a Paris ell; at Florence, $\frac{49}{100}$ of a Paris ell: at Milan the brace for silks is 4-9ths of a Paris ell; and that for woollen cloths, the same as in Holland: at Bergama the brace is 5-9ths of a Paris ell. The usual measure at Naples is the canna, containing $1\frac{11}{17}$ of a Paris ell.

Spanish MEASURE, is the vara, containing $\frac{17}{24}$ of the Paris ell: but in Castile and Valentia, the measure is the pau, span, or palm; which is used, with the canna, at Genoa. In Arragon, the vara is equal to a Paris ell and a half.

Portugueze MEASURE, is the covodo, containing 4-7ths of the Paris ell; and the vara, of which 106 make 100 Paris ells.

Piedmontese

Piedmontese Measure, is the covedos, containing 4-7ths of the Paris ell. In Sicily the measure is the canna, the same with that of Naples.

Muscovite Measures, are the cubit, equal to 1 Paris foot, 4 inches, 2 lines; and the arcin, 2 whereof are equal to 3 cubits.

Turkish and Levant Measures, are the picq, containing 3-5ths of the Paris ell. The Chinese measure is the cobre, 10 of which are equal to 3 Paris ells. In Persia, and some parts of the Indies, the gueze, of which there are two kinds; the royal gueze, or gueze monkelser, containing 4-5ths of the Paris ell; and the shorter gueze, only 2-3ds of the former. At Goa and Ormus, the measure is the Portuguese vara. In Pegu, and other parts of the Indies, the cando, equal to the Venice ell. At Goa, and other parts, they use a larger cando, equal to 17 Dutch ells. In Siam they use the ken, short of 3 Paris feet by an inch: the ken contains 2 socks, the sock 2 keubs, the keub 12 nions or inches: the nion is equal to 8 grains of rice, that is, about 9 lines. At Camboia, the haster; in Japan, the tatam; and the span on some of the coasts of Guinea.

English *Long* Measure.

inch											
3	palm										
9	3	span									
12	4	1⅓	foot								
18	6	2	1½	cubit							
36	12	4	3	2	yard						
45	15	5	3¾	2½	1¼	ell					
60	20	6⅔	5	3½	1¾	1¼	pace				
72	24	8	6	4	2	1¾	1⅕	fathom			
198	66	22	16½	11	5½	4	3 1/10	2¾	pole		
7920	2640	880	660	440	220	176	132	110	40	furlong	
63360	21120	7040	5280	3520	1760	1408	1056	880	320	8	mile

Jewish *Long or Itinerary* Measures.

						Eng. miles.	*paces.*	*feet. dec.*
cubic						0	0	1.824
400	stadium					0	145	4.6
2000	5	Sab. day's journey				0	729	3.0
4000	10	2	eastern mile			1	403	1.0
12000	30	6	3	parasang		4	153	3.0
96000	240	48	24	8	a day's journey	33	172	4.0

Roman

Roman *long* MEASURE, *deduced to English.*

										paces.	*feet*	*inch. dec.*
digitus transversus										0	0	$0.725\frac{1}{4}$
$1\frac{3}{4}$	uncia									0	0	0.967
4	3	palmus minor								0	0	2.901
16	12	4	pes							0	0	11.604
20	15	5	$1\frac{1}{4}$	palmipes						0	1	2.505
24	18	6	$1\frac{1}{2}$	$1\frac{1}{5}$	cubitus					0	1	5.406
40	30	10	$2\frac{1}{2}$	2	$1\frac{2}{3}$	gradus				0	1	5.01
80	60	20	5	4	$3\frac{1}{3}$	2	passus			0	4	10.02
10000	7500	2500	625	500	$416\frac{2}{3}$	250	215	stadium		120	4	4.5
80000	60000	20000	5000	4000	$3333\frac{1}{3}$	2000	1000	8	milliare	967	0	0

Proportions of the long MEASURES *of several nations to the English foot.*

The English standard foot being divided into 1000 equal parts, the other measures will have the proportions to it, which follow.

The	English foot from the standard at Guild-hall	1000
	Paris royal foot, in the Chatelet	1068
	Rhinland foot of Snellius	1033
	Greek foot	$1007\frac{29}{100}$
	Roman foot on the monument of Cossutius	967
	Roman foot of Villalpandus, taken from the congius of Vespasian	986
	Venetian foot	1162
	ell of Amsterdam	2268
	Amsterdam foot	942
	ell of Antwerp	2283
	foot of Antwerp	946
	ell of Leyden, in Holland	2260
	canna of Naples	6880
	vara of Almeria, and Gibraltar, in Spain	2760
	Spanish foot	1001
	Toledo foot	899
	braccio of Florence	1913
	palm of Genoa	815
	common braccio of Sienna	1242
	braccio of Sienna for linen	1974
	palm of the architects at Rome, whereof 10 make the canna of the same architects	732
	palm of the braccio for the merchants and weavers at Rome, from a marble in the Capitol, with this inscription, CURANTE LV POETO	$995\frac{1}{2}$
	large pique of the Turks at Constantinople	2200
	small pique of the Turks at Constantinople is to the larger as 31 to 32	
	arish of Persia	3197
	derah or cubit of the Egyptians	1824
	Dort foot in Holland	1184
	Middleburg foot	991
	Strasbourg foot	920
	Bremen foot	964
	foot of Cologn	954
	foot of Frankfort on the Main	948
	Dantzick foot	944
	foot of Copenhagen	965
	foot of Prague	1026
	Riga foot	1831
	foot of Mantua	1585
	foot of Bononia	1204
	foot of Mechlin	919
	foot of Stockholm	$963\frac{1}{2}$
	foot of Lisbon	1005

English square or superficial MEASURES, are raised from the yard of 36 inches multiplied into itself; and this producing 1296 square inches

inches in the square yard, the divisions of this are square feet and inches, and the multipliers, poles, roods, and acres.

English *square* Measure.

inches						
144	feet					
1296	9	yards				
3600	25	2	paces			
39204	272¼	30¼	10,89	poles		
1568160	10890	1210	435,6	40	roods	
6272640	43560	4840	1743,6	160	4	acr.

French square Measures, are regulated by 12 square lines in the inch square, 12 inches in the foot, 22 feet in the perch, and 100 perches in the arpent or acre.

Cubical Measures, or measures of capacity for liquors. English liquid measures were originally raised from troy weight, it being ordained that 8 pounds troy of wheat, gathered from the middle of the ear, and well dried, should weigh a gallon of wine measure; yet a new weight, viz. the avoirdupoise weight, has been introduced, to which a second standard gallon is adjusted, exceeding the former in the proportion of the avoirdupoise weight to the troy weight. From this latter standard are raised 2 measures, the one for ale, the other for beer.

The sealed gallon at Guildhall, which is the standard for wine, spirits, oil, &c. is supposed to contain 231 cubic inches; yet, by actual experiment made in 1688, before the lord mayor and commissioners of excise, it only contains 224 cubic inches. It was however agreed to continue the common supposed contents of 231: hence, as 12 : 231 :: $14\frac{12}{20}$: 281¼, the cubic inches in an ale gallon; but, in effect, the ale quart contains 70½ cubic inches; on which principles, the ale and beer gallon will be 282 cubic inches.

Dry Measure, is different from both the ale and wine measure, being nearly a mean between both.

According to an act of parliament passed in 1697, every round bushel with a plain and even bottom, being made 18½ inches throughout, and 8 inches deep, is to be accounted a legal Winchester bushel, according to the standard in his majesty's exchequer; consequently a corn gallon will contain 268.8 inches, as in the following table.

inches				
2688	gallons			
5376	2	pecks		
21504	8	4½	bushels	
172032	64	32	8	quarters

Measure *of wood for firing*, is the cord, being 4 feet high, as many broad, and 8 long: it is divided into 2 half-cords.

Measure *for horses*, is the hand, which by statute contains 4 inches.

Powder Measures, made of copper, holding from an ounce to 12 pounds, are very convenient in a siege, when guns or mortars are loaded with loose powder, especially in ricochet-firing, &c.

As powder measures are useful in artillery, being more handy than weights, saving time, &c. we shall insert here some experiments made by professor Muller upon that subject, in 1753, at the royal military academy at Woolwich.

1. A cylinder, whose axis and diameter were 2 inches each, contained 3 ounces and 3 grains, or 51 grains; and as similar cylinders are as the cubes of their axes, we say 51 grains are to 256 grains, or 1 pound, as the cube 8 of 2 inches is to the cube 40.156 of the diameter of a like cylinder holding 1 pound.

2. A cylinder, whose axis and diameter were 4 inches each, held 25 ounces and 10.5 grains, or 410.5 grains: whence 410.5 grains are to 256 grains, as the cube 64 of 4 inches is to 39.912, the cube of the axis of a cylinder holding 1 pound.

3. A cylinder, whose diameter and axis were 6 inches each, held 5 pounds 6 ounces and 6 grains, or 1382 grains: hence 1382 : 256 :: 216 : 40.01 for the cube required.

4. A two-inch cube held 4 ounces and 1 grain, or 65 grains: and as 452 is to 355, so is the cube 8 of the axis to the content of the cylinder, which therefore is 51.05 : hence 65 : 256 :: 8 : 40.117, the cube of the axis.

5. A six-inch cube held 6 pounds 13 ounces and 13 grains, or 1757 grains: so then 452 : 355 :: 1757 : 1379.944, or 1380, the content of the cylinder: and if 1380 : 256 :: 216 : 40.07, this 4th term will be the cube of the

axis

axis required. Hence a medium of these 5 experiments gives 40.053 cubic inches, whose cube root 3.42 will be the diameter of a cylinder holding a pound of powder.

Diameters and heights of cylindric Powder MEASURES *from* 1 *to* 39 *ounces.*

℥	0	1	2	3	4	5	6	7	8	9
0	0	1.357	1.710	1.957	2.154	2.321	2.467	2.596	2.714	2.830
1	2.924	2.963	3.107	3.191	3.271	3.347	3.420	3.490	3.575	3.622
2	3.684	3.744	3.803	3.859	3.915	3.968	4.021	4.072	4.121	4.170
3	4.217	4.263	4.309	4.353	4.397	4.439	4.481	4.523	4.563	4.603

N. B. The logarithm of an ounce is .1326467: the other numbers are found by adding ⅓ of the number of the logarithm of the number of ounces: thus the number of 8 ounces is found by adding .3010300, ⅓ of the logarithm of 8 to that of 1 ounce, which gives .4336767 for the logarithm of the number sought, which therefore is 2.714. See the above table.

Diameters and heights of cylindric Powder MEASURES *from* 1 *to* 39 *pounds.*

℔	0	1	2	3	4	5	6	7	8	9
0	0	3.420	4.309	4.932	5.429	5.848	6.214	6.541	6.824	7.114
1	7.368	7.606	7.830	8.041	8.243	8.434	8.618	8.794	8.963	9.126
2	9.283	9.435	9.583	9.726	9.865	10.00	10.13	10.26	10.38	10.51
3	10.63	10.74	10.86	10.97	11.08	11.16	11.29	11.45	11.50	11.60

Diameters of cylindric Powder MEASURES, *when the diameter is to the axis as* 2 *to* 3.

℥	0	1	2	3	4	5	6	7	8	9
0	0	1.181	1.491	1.710	1.880	2.027	2.[illegible]55	2.268	2.371	2.472
1	2.554	2.588	2.714	2.788	2.[illegible]57	2.92[illegible]	2.988	3.049	3.164	3.184
2	3.218	3.271	3.322	3.371	3.420	3.466	3.513	3.557	3.600	3.643
3	3.684	3.724	3.764	3.802	3.841	3.878	3.915	3.951	3.986	4.021

℔	0	1	2	3	4	5	6	7	8	9
0	0	2.988	3.764	4.308	4.743	5.109	5.428	5.714	5.961	6.215
1	6.436	6.644	6.840	7.024	7.201	7.368	7.529	7.682	7.830	7.972
2	8.109	8.242	8.372	8.496	8.618	8.73[illegible]	8.849	8.963	9.068	9.181
3	9.286	9.382	9.4[illegible]6	9.583	9.679	9.769	9.769	9.863	10.00	10.13

These

These diameters are found, if those of the former tables be divided by 1.1447, the cube root of 3-2ds.

MEASURE-*angle*, a brass instrument to measure angles, either salient or rentrant, for exactly ascertaining the number of degrees and minutes, to delineate them on paper.

MEASURING, MENSURATION, } in *military mathematics*, the assuming any certain quantity, and expressing the proportion of other similar quantities to the same; or the determining, by a certain known measure, the precise extent, quantity, or capacity of any thing.

MEASURING, in *general*, constitutes the practical part of geometry: and from the various subjects about which it is conversant, it acquires various names, and constitutes various arts, viz.

See LONGIMETRY, ALTIMETRY, LEVELLING, GEODESIA, or SURVEYING, STERIOMETRY, SUPERFICIES and SOLIDS, &c.

MEASURING. See CHAIN.

MECHANICS, a mixed mathematical science, which considers motion and moving powers, their nature and laws, with the effects thereof, in machines, &c. The word is derived from the Greek μηχανικη, which signifies the same thing, and derived from μηχανη, an instrument or skill. That part which considers motion arising from gravity, is sometimes called statics, in contradistinction from that part which considers the mechanical powers and their application, properly called mechanics.

MECHANICAL, something relating to mechanics.

MECHANICAL *philosophy*, that which explains the phænomena of nature, and the operations of corporeal things, on the principles of mechanics; namely, the motion, gravity, figure, arrangement, &c. of the parts which compose natural bodies.

MECHANICAL *powers*, or *machines*, are 6 in number, viz. the lever, the pully, the wheel and axle, the inclined plane, the wedge and the screw.

They are called mechanical powers, because they increase our power of moving or raising heavy bodies, which are often unmanageable by any human strength, not thus assisted; and of two or more of these all other compound machines are composed.

As the learned Dr. Hamilton, professor of mathematics in the university of Dublin, has lately published a new theory of the mechanical powers, and displayed the principles on which we may best explain their nature and manner of acting; we shall lay before our readers the substance of his ingenious essay in his own words.

"The many useful instruments, says this able mathematician, that have been so ingeniously invented, and so successfully executed, and the great perfection to which the mechanic arts are now arrived, would naturally incline one to think that the true principles on which the efficacy and operations of the several machines depend, must long since have been accurately explained. But this is by no means a necessary inference; for, however men may differ in their opinions about the true method of accounting for the effects of the several machines, yet the practical principles of mechanics are so perfecty known by experience and observation, that the artist is thereby enabled to contrive and adjust the movements of his engines with as much certainty and success as he could do, were he thoroughly acquainted with the laws of motion, from which these principles may be ultimately derived. However, though an enquiry into the true method of deducing the practical principles of mechanics from the laws of motion, should perhaps not contribute much to promote the progress of the mechanic arts, yet it is an enquiry in itself useful, and in some measure necessary; for, since late authors have used very different methods of treating this science, it may be supposed that no one method has been looked upon as satisfactory, and unexceptionable. I shall therefore wish to contribute towards having this subject treated with more accuracy than has hitherto been done.

"The most general and remarkable theorem in mechanics is certainly this: that when two weights, by means of a machine, counterpoise each other, and are then made to move together, their quantities of motion will be equal. Now, an equilibrium always accompanying this equality of motions, bears such a resemblance to the case wherein two moving bodies stop each other, that Dr. Wallis, and after him most of the late writers, have thought the cause of an equilibrium in the several machines might be immediately assigned, by saying, that since one body cannot produce in another a quantity of motion equal to its own, without losing its own at the same time; two heavy bodies counteracting each other by means of a machine must continue at rest, when they are so circumstanced that one cannot descend without

causing the other to ascend at the same time, and with the same quantity of motion; and, therefore, two heavy bodies, in such cases, must always counterbalance each other. Now this argument would be a just one, if it could properly be said that the motion of the ascending body was produced by that of the descending one; but, since the bodies are so connected that one cannot possibly begin to move before the other, I apprehend, that, if bodies are supposed to move, it cannot be said that the motion of one is produced by that of the other: since whatsoever force is supposed to move, one must be the immediate cause of motion in the other also; that is, both their motions must be simultaneous effects of the same cause, just as if the two bodies were really but one: and, therefore, if I was to suppose, in this case, that the superior weight of the heavier body (which may be in itself much more than able to sustain the lighter) should overcome the weight of the lighter, and produce equal motions in both bodies; I do not think that from thence I could be reduced to the absurdity of supposing, that one body, by its motion, might produce in another a motion equal to its own, and yet not lose its own at the same time. But those who argue from the equality of motions on this occasion say further, that, since the two bodies must have equal motion when they do move, they must have equal endeavours to move even while at rest, and therefore these endeavours to move, b ing equal and contrary, must destroy each other, and the bodies must continue at rest, and consequently balance each other. In answer to this I must observe, that the absolute force with which a heavy body endeavours to descend from a state of rest, can only be proportionable to its weight; and therefore I think it is necessary, that some cause should be assigned why (for instance in the lever) the endeavour of one pound to descend shall be equal to that of 4 pounds; and especially as the fulcrum on which both weights act requires no greater force to support it than that of 5 pounds.

"From these considerations I infer, that the reason why very unequal weights may balance each other, should be assigned not from their having momenta when made to move together, but by proving *à priori*, without considering their motions, that either the re-action of the fixed parts of the machine, or some other cause, so far takes off from the weight of the heavier body as to leave it only just able to support the lighter. However, as this equality of momenta which always accompanies an equilibrium, affords a very elegant theorem, it should be taken notice of in every treatise of mechanics, and may serve as an index of an equilibrium. But I would not have it applied to a purpose for which it is unfit; as it has in another instance by Dr. Kiel, who from thence gives the reason why water stands at the same height in a narrow tube and a wide vessel with which it communicates: and an argument of the same kind is applied still more improperly by Dr. Rutherforth, and others, to shew why a drop of water included in a small conical tube will move towards the narrower end: and yet the true ways of accounting for both these phænomena are extremely obvious and easy.

"The simple mechanic powers are usually reckoned 6, the lever, axle and wheel, pully, wedge, inclined plane, and screw. The only method I have met with of explaining the nature of these machines upon one and the same principle, is that which I just now examined; and as that appears to me unsatisfactory, I shall consider the nature of each machine separately, in the order I have set them down.

"The lever is said to be a right line, inflexible and void of weight. Its fundamental property is this: when any two forces act against each other on the arms of a lever, they will continue in equilibrio, if their quantities are inversely as the distances between the points to which they are applied and the point round which the lever turns; which point is called the fulcrum, or prop.

"Several methods have been used, by different authors, to prove, that this property belongs to the lever. We find in the works of Archimedes, a proof brought for this purpose, which has since been made use of by several writers of mechanics; who, I find, have somewhat altered the form of his argument, the subject of which is generally expressed as follows: When a cylinder of any uniform matter is supported at its middle point, it will continue at rest; for all the parts on one side must balance those on the other, being exactly equal to them both in weight and situation; so that the whole weight of this cylinder may be looked upon as acting on the middle point on which it is supported. From whence it follows, that the weight of such a cylinder will act upon whatever supports it, in the same manner as it would do if it was all contracted into the middle point of its axis. If therefore we suppose the cylinder to be distinguished into two unequal cylinders or segments, the distances between the middle points of those segments and the middle of the whole

cylinder

cylinder will be inversely as the lengths of the segments; that is, inversely as their weights: but, as it was said before, the weight of each cylinder acts in the same manner as it would do if contracted into the middle point of its axis; and therefore if the weights of those cylinders be contracted into these points, they will continue to support each other as before: and thence it is concluded, that any two weights, acting against each other on a line sustained at a fixed point, will counterpoise each other, when they are inversely as the distances of the points on which they act, from the point on which the line rests. To this agreement there seems to be a manifest objection; for, when the whole cylinder is distinguished into two segments, part of the weight of the greater segment acts on the same side of the fulcrum with the lesser segment; and therefore when the whole weight of the greater segment is contracted into its middle point on one side of the fulcrum, and acts all of it against the lesser segment, it requires at least some proof to shew, that this contracted weight will be balanced by the weight of the lesser segment. Mr. Hugens, in his miscellaneous observations on mechanics, takes notice of this objection to Archimedes's method, which, he says, several mathematicians had endeavoured to remove, but without success. He therefore, instead of this method, proposed one of his own, which depends on a postulatum that he uses in common with Archimedes, and which I think should not be granted on this occasion: it is this; when equal bodies are placed on the arms of a lever, the one which is furthermost from the fulcrum will prevail and raise the other up. Now, this is taking it for granted, in other words, that a small weight placed further from the fulcrum will support or raise a greater one. The cause and reason of which fact must be derived from the demonstration that follows; and therefore this demonstration should not be founded on the supposed self-evidence of what is partly the thing to be proved. But perhaps it may be said, that the postulatum may be granted merely on this account; that the centre of gravity of the two bodies (which in this case is the middle point between them) is not sustained; and therefore the body, which is on the same side of the fulcrum with the centre of gravity, will descend.

"In answer to which I must observe, that this property, which the centre of gravity has of descending, when not placed directly above or below the point of suspension, cannot be proved to belong to it in any case; nor can we even shew that there is only one centre of gravity between two bodies joined by a right line, until it is proved in general that the centre of gravity of any two bodies is a point so placed between them, that their distances from it are inversely as their weights: but this in effect includes the principal property of the lever, which therefore cannot be proved from any previous supposition, that the centre of gravity will descend, even when the bodies are equal, and we know it is the middle point between them.

"I must now proceed to consider what Sir Isaac Newton hath delivered on this subject in his *Principia*, after the 2d cor. to the 3d law of motion, which Dr. Clarke, (in his notes on Rohault) and all the subsequent writers, have quoted as an elegant proof of the property of the lever; and therefore what appears to me at present an objection to this proof, I shall mention with great diffidence, and in hopes of being set right, if I am wrong. Sir Isaac supposes two weights, as *A* and *P* (pl. I. fig. 8*.) to hang by threads, from the points *M* and *N* in a wheel or circular plane perpendicular to the horizon, and moveable about its centre *O*; and then proposes to determine the forces with which these weights act to turn the wheel round its centre. In order to do this, he supposes that it is indifferent from what points in the perpendicular lines *M A* and *N P* the weights are hung, for that they will still have the same power to turn the wheel about its centre. His words are, *Quoniam nil refert utrum filorum puncta K, L, D, affixa sint vel non affixa ad planum rotæ; pondera idem valebunt ac si suspenderentur a punctis K et L, vel D et L.* Now whether the points of the threads *L, L, D*, are fixed or not to the plane of the wheel, is certainly of importance, as it must make a difference in the points of suspension of the weights, and consequently in the degrees of obliquity with which the weights act; for the lowest point of the thread that is fixed to the plane must be considered as the point from which the weight hangs; as the parts of the thread above that point are quite useless, not being at all acted upon. And from thence I shall endeavour to shew, that to suppose the weight *A* will have the same power to turn the wheel from whatever point in the line *M A* it hangs, is in effect presupposing what is intended to be proved. For it appears, from what he says immediately after, that, when the weight *A* hangs from the point *D*, if its whole force be expressed by the line *AD*,"

AD, and be resolved into two forces, DC and AC, the former only will have any effect in turning the wheel, as it acts perpendicularly on the radius OD, while the latter is lost, its direction being parallel to OD. But it is evident, that, when the same weight hangs from the point K, as it acts perpendicularly on the radius OK, its whole force is exerted to turn the wheel, and none of it lost by oblique action.

" Therefore, the force which the weight A, exerts to oppose the weight P, and turn the wheel when it hangs from D, is, to the force it exerts when it hangs from K, as the line DC to AD, or as OK to OD, (sim. triang. ADC, DOK) that is, the forces exerted by the weight A, hanging from the points D and K, are inversely as the radii OD and OK. And therefore to suppose, that these two forces will have the same effect in turning the wheel and opposing the weight P, is the same as supposing that two forces will have equal effects in moving the arms of a lever (on which they act perpendicularly) when they are inversely at the lengths of those arms. But this is the very conclusion Sir Isaac draws from his premises; for he says, *Pondera igitur A et P, quæ sunt reciproce ut radii in directum positi OK, OL, idem pollebunt et sic consistent in æquilibrio, quæ est proprietas notissima libræ, vectis et axis in peritrochio.* But further, this property of the lever, which is here expressed in general terms, includes two cases; for the arms of the lever may be either perpendicular or oblique to the directions of the weights. The first of these cases is the simplest, and should be first demonstrated: and I do not see how there can be any room for applying the resolution of forces in demonstrating this case, in which no part of any weight is lost by oblique action. But when this case is proved, we have from thence, by the resolution of forces, an easy way of shewing, in the second case, when the arms of the lever are oblique to the directions of the weights, that the weights will counterbalance each other, when they are reciprocally as the perpendicular distances of their lines of direction from the centre of motion. From the last of these cases, we may deduce an obvious reason why the weight A should have the same power to turn the wheel, from whatever point it hangs in the line MA; the truth of which, I am persuaded, cannot be proved independent of those cases, and therefore think it should not be used as a postulatum in demonstrating the general property of the lever.

" Mr. Maclaurin, in his view of Newton's Philosophy, after giving us the methods which Archimedes and Newton have used for proving the fundamental property of the lever, proposes one of his own, which, he says, appears to be the most natural one for this purpose. However, as to his method I shall only observe, that, from equal bodies sustaining each other at equal distances from the fulcrum, he shews us how to infer that a body of one pound (for instance) will sustain another of two pounds at half its distance from the fulcrum; and from thence that it will sustain one of three pounds at a third of its distance from the fulcrum: he goes on, declaring, by a kind of induction, what the proportion is in general between two bodies that sustain each other on the arms of the lever. But this argument, he observes, cannot be applied when the arms of the lever are incommensurable; and therefore it cannot conclude generally, and consequently is imperfect.

" These are the methods of demonstrating the fundamental property of the lever, which are worth taking notice of; and, since they seem liable to exceptions, and the other methods I have met with are still more exceptionable, I shall propose a new proof of this property of the lever, which appears to me a very simple one, and depends on a postulatum that, I believe, will be readily granted.

" If a force be universally diffused over a right line, that is, if an equal part of the force acts upon every point of the line, and if the whole force acts according to one and the same plane; this force will be sustained, and the line kept in equilibrio, by a single force applied to the middle point of the line equal to the diffused force, and acting in a contrary direction.

" In order to shorten the following proof, I must premise, by way of lemma, that, if a right line be divided into two segments, the distance between the middle of the whole line, and the middle points of the segments, will be inversely as the segments. This is self-evident when the segments are equal; and, when they are unequal, then, since half of the whole line is equal to half of the greater and half of the lesser segment, it is plain that the distance between the middle of the whole line and the middle of one segment must be equal to half of the other segment, so that these distances must be to each other inversely as the segments; all which appear evident from the inspection of fig. 9.

" Let now the line GH, (fig. 10.) whose middle point is D, be divided into unequal segments GL, and LH, whose middle points are C and F, and let two forces or weights A and

and *B*, which are to each other as the segments *G L* and *L H*, be applied to their middle points *C* and *F*, and let them act perpendicularly on the line *G H*. Then (by the lemma) the weight *A* and *B* will be to each other inversely as *C D*, and *F D*, (the distances of the points *C* and *F*, to which they are applied from the middle of the whole line): if then a third force or weight *E*, equal to the sum of the forces *A* and *B*, be applied to the point *D*, and acts on the line in an opposite direction; I say, then, these three forces will sustain each other, and keep the line in equilibrio. For let us suppose the force *E* to be removed, and instead of it another force, equal also to the sum of *A* and *B*, to be uniformly diffused over the whole line *G H*, and to act directly against the forces *A* and *B*, then the part of this force which acts on the segment *G L*, will be equal to the force *A*, and therefore will be sustained by it (*postulatum*); and the other part, which is diffused over the segment *L H*, will be equal to and sustained by the force *B*, so that the forces *A* and *B* will sustain this diffused force, and keep the line in equilibrio. Let now two other forces act also on this line in opposite directions, one of them the force *E* acting on the point *D*, as it was first supposed to do, and the other an uniformly diffused force equal to *E* (and consequently equal to the other diffused force): then these two additional forces will also balance each other, and therefore the equilibrium will still remain: so that the two forces *A* and *B*, and a diffused force acting on one side of the line, sustain the force *E* and a diffused force acting on the other side: but it is manifest, that in this equilibrium, the two diffused forces acting on opposite sides are perfectly equivalent; and therefore, if they are taken away from both sides, the equilibrium must still remain. Hence it appears, that the three weights or forces *A*, *B*, and *E*, any two of which are (by the construction) to each other inversely as their distances from the third, will sustain each other, and keep the line on which they act in equilibrio; which is the first and most simple case of the property of the lever; for here the directions of the weights are supposed to be perpendicular to the line on which they act; and it is evident that, if one of the points *C*, *D*, or *F*, be fixed or considered as a fulcrum, the weights acting on the other two points will continue to support each other.

" I shall not now take the trouble of proving the second case of the second property of the lever: it is most easily deduced from the first; for when two weights act on the arms of a lever in oblique directions, and are to each other inversely as the perpendicular distances of their lines of direction from the centre of motion, then, by the revolution of forces, it is easily proved that the parts of those forces which act perpendicularly on the arms of the lever, and which only are exerted to turn the lever, are to each other inversely as the lengths of those arms; and therefore by the first case they must balance each other.

" I shall now mention some well-known truths in mechanics, which, I think, cannot be proved otherwise than by deducing them from what hath been here demonstrated.

" *Corollary* 1. It appears from hence, that the powers with which any two forces move or endeavour to move the arms of a lever, are as the rectangles, under lines proportional to the forces, and the perpendicular distances of their lines of direction from the fulcrum.

" *Cor.* 2. When therefore two bodies acting on the arms of a lever sustain each other, if one of them be removed farther from the fulcrum, it will preponderate; but if it be brought nearer to the fulcrum, the other weight will prevail; because the product to which its force is proportionable will be increased in the first case, and diminished in the second.

" *Cor.* 3. We learn from hence to find out the centre of gravity of any two bodies joined by an inflexible right line, and to prove that its definition will agree to one point only in the line. For if a point be taken in the line, so that the distances of the bodies from it may be inversely as their weights, that point will be the centre of gravity; because, when it is sustained, the bodies will be in equilibrio. But if the line is sustained at any other point, then is the fulcrum removed further from one body, and brought nearer to the other, than it was when the bodies balanced each other; and therefore, by preceding *Cor.* that body from which it is removed, or which is on the same side with the centre of gravity, will descend: consequently there is but one point in the line, which being sustained, the bodies will be in equilibrio, and therefore but one point only can be their centre of gravity. Hence also it appears, that the centre of gravity will always descend, when it is not directly above or below the point by which the body is sustained.

" I shall now endeavour to be as concise as possible in what I have to say of the other mechanic powers; having, I fear, been too tedious in my account of the lever, which, however,

ever, deserves to be particularly considered, since to it may be reduced the balance, the axle and wheel, and (according to some writers) the pully.

"The balance I do not consider as a distinct machine, because it is evidently no other than a lever fitted to the particular purpose of comparing weights together; and does not serve for raising weights, or overcoming resistances, as the other machines do.

"When a weight is to be raised by means of an axle and wheel, it is fastened to a cord that goes round the axle; and the power, which is to raise it, is hung to a cord that goes round the wheel. If then the power be to the weight as the radius of the axle to the radius of the wheel, it will just support that weight; as will easily appear from what was proved of the lever. For the axle and wheel may be considered as a lever, whose fulcrum is a line passing through the centre of the wheel and middle of the axle, and whose long and short arms are the radii of the wheel and axle, which are parallel to the horizon, and from whose extremities the cords hang perpendicularly. And thus an axle and wheel may be looked upon as a perpetual lever, on whose arms the power and weight always act perpendicularly, though the lever turns round its fulcrum. And in like manner, when wheels and axles move each other by means of teeth on their peripheries, such a machine is really a perpetual compound lever: and, by considering it as such, we may compute the proportion of any power to the weight it is able to sustain by the help of such an engine. And since the radii of two contiguous wheels, whose teeth are applied to each other, are as the number of teeth in each, or inversely as the number of revolutions which they make in the same time; we may, in the computation, instead of the ratio of these radii, put the ratio of the number of teeth on each wheel, or the inverse ratio of the number of revolutions they make in the same time.

"Some writers have thought the nature and effects of the pully might be best explained by considering a fixed pully as a lever of the first, and a moveable pully as one of the second kind. But though the pully may bear being considered in that light, yet, I think, the best and most natural method of explaining its effects (that is, of computing the proportion of any power to the weight it can sustain by means of any system of pullies) is, by considering that every moveable pully hangs by two ropes, equally stretched, which must bear equal parts of the weight; and therefore, when one and the same rope goes round several fixed and moveable pullies, since all its parts on each side of the pullies are equally stretched, the whole weight must be divided equally amongst all the ropes by which the moveable pullies hang: and consequently, if the power which acts on one rope be equal to the weight divided by the number of ropes, or double the number of moveable pullies, that power must sustain the weight.

"Upon this principle, the proportion of the power to the weight it sustains by means of any system of the pullies, may be computed in a manner so easy and natural as must be obvious to every common capacity.

"The proportion which any power bears to the resisting force it is able to sustain by means of a wedge, has been laid down differently by different authors, as they happened to consider it in particular cases. Without examining their several opinions, I shall endeavour to express this proportion in one general proposition, which may extend to the several cases in which the wedge is applied.

"Let the equicrural triangle ABC, (*fig.* 10.) represent a wedge: the lines AB and CB will be the sides of the wedge, AC its base or back, and its height will be the line PB bisecting the base AC, and also the vertical angle ABC. When any two resisting forces act on the sides of a wedge in directions which make equal angles with the sides (as they are always supposed to do) a power acting perpendicularly at P, on the base of the wedge, will keep the resisting forces in equilibrio, when it is to the sum of these forces, as the sine of half the vertical angle of the wedge, to the sine of the angle which the directions of the forces contain with the sides of the wedge.

"For let E and F be two bodies acting on the sides of the wedge, and let them be first supposed to act in the directions EP and FP perpendicular to the sides; then since the power P acts perpendicularly on the base AC, if these three forces keep the wedge in equilibrio, they will be to each other as the sides of a triangle, to which their directions are parallel, or (which is the same thing) as the sides of the triangle ABC, to which their directions are perpendicular. Therefore the power P, is to the sum of the resisting forces which it sustains, as AC the base of the wedge to the sum of the sides, or as PA, ½ the base, to AB one of the sides; but PA is to AB as the sign of PBA, ½ the vertical angle of the wedge, to the radius which is the sign of a right

right angle, and the directions of the resisting forces are supposed in this case to contain a right angle with the sides of the wedge.

"Let now the resisting bodies *E* and *F* be supposed to act on the wedge in directions parallel to the lines *DP* and *OP*, which make oblique angles with its sides: draw *EG* and *FK* perpendicular to those lines. From what has been proved it appears, that the power *P* is to the force with which it is able, by means of the wedge, to protrude the resisting bodies in the directions *PE* and *PF*, as the sine of ½ the vertical angle to the radius: let this protruding force be expressed by the line *PE*, and let it be resolved into two forces expressed by the lines *PG* and *GE*: the former of these only will act in opposition to the resisting bodies; therefore the whole protruding force of the power is, to the force with which it acts against the resisting bodies *PE* and *PF* in the directions *PD* and *PO*, as *PE* to *PG*, or (because the triangles *EPG* and *DPE* are similar) as *PD* to *PE*, that is, as the radius to the sine of the angle *PDE*; compounding therefore the ratio of the sine of ½ the vertical angle to the radius, with the ratio of the radius to the sine of the angle *PDE*, the power *P*, when the wedge is kept in equilibrio, will be, to the force with which it protrudes the resisting bodies in directions opposite to those in which they act, as the sine of ½ the vertical angle to the sine of the angle *PDE* or *POE*, which the directions of the resisting forces contain with the sides of the wedge.

"Hence, when the directions in which the resisting bodies act on a wedge are given, we may easily find two lines that will express the proportion between the resistance and the power which sustains it by means of the wedge. For from *P*, the middle point of the wedge, draw the line *PD* meeting one of the sides, and parallel to the direction in which the resisting force acts on that side, then the power will be to the resistance as *PD* to *PB*, the height of the wedge. For *PD* and *PB* are to each other as the sines of the opposite angles, in the triangle *PBD*, that is, as the sines of ½ the vertical angle, and the angle which the direction of the resisting force contains with the sides of the wedge.

"From what hath been demonstrated we may deduce the proportion of the power to the resistance it is able to sustain in all the cases in which the wedge is applied. First, when in cleaving timber the wedge fills the cleft, then the resistance of the timber acts perpendicularly on the sides of the wedge; therefore, on this case, when the power which drives the wedge, is to the cohesive force of the timber, as ½ the base to one side of the wedge, the power and resistance will be in equilibrio.

"Secondly, when the wedge does not exactly fill the cleft, which generally happens because the wood splits to some distance before the wedge. Let *ELF* represent a cleft, into which the wedge *ABC* is partly driven: as the resisting force of the timber must act on the wedge in direction perpendicular to *EL*, the side of the cleft, and meeting the side of the wedge in *D*; then the power driving the wedge, and the resistance of the timber, when they balance, will be to each other as the line *PD* to *PB*, the height of the wedge.

"Thirdly, when a wedge is employed to separate two bodies that lie together on an horizontal plane, for instance, two blocks of stone; as these bodies must recede from each other in horizontal directions, their resistance must act on the wedge in lines parallel to its base *CA*; therefore the power that drives the wedge will balance the resistance when they are to each other as *PA*, ½ the breadth of the wedge, to *PB*, its height; and then any additional force, sufficient to overcome the resistance arising from the friction of the bodies on the horizontal plane, will separate them from each other.

"The inclined plane is reckoned by some writers among the mechanic powers; and I think with reason, as it may be used with advantage in raising weights.

"Let the line *AB* (*fig.* 11.) represent the length of an inclined plane, *AD* its height, and the line *BD* we may call its base. Let the circular body *GEF* be supposed to rest on the inclined plane, and to be kept from falling down it by a string *CS* tied to its centre *C*. Then the force with which this body stretches the string will be to its whole weight, as the sine of *ABD*, the angle of elevation, to the sine of the angle which the string contains with a line perpendicular to *AB*, the length of the plane. For let the radius *CE* be drawn perpendicular to *AB*, and from *E* draw *EO* parallel to the string, and meeting *GF* in *O*; then, as the body continues at rest, and is urged by three forces, to wit, by its weight in the direction *CE*, by the reaction of the plane in the direction *EO*; the reaction of the string, or the force by which it is stretched, is to the

the weight of the body, as EO to CE; that is, as the fine of (the angle ECO, which is equal to) ABD, the angle of elevation, to the fine of the angle EOC, equal to SCO, the angle which the ftring contains with the line CF perpendicular to AB, the length of the plane.

" When therefore the ftring is parallel to the length of the plane, the force with which it is ftretched, or with which the body tends down the inclined plane, is, to its whole weight, as the fine of the angle of elevation, to the radius, or as the height of the plane to the length. And in the fame manner it may be fhewn, that when the ftring is parallel to BD, the bafe of the plane, the force with which it is ftretched is, to the weight of the body, as AD to BD; that is, as the height of the plane is to its bafe. If we fuppofe the ftring, which fupports the body GEF, to be faftened at S, and that a force, by acting on the line AD, the height of the plane, and in a direction parallel to the bafe BD, drives the inclined plane under the body, and by that means makes it rife to a direction parallel to AD: then, from what was proved in the third cafe of the wedge, it will appear, that this force muft be to the weight of the body, as AD to BD, or rather in a proportion fomewhat greater; if it makes the plane move on, and the body rife.

" From this laft obfervation we may clearly fhew the nature and force of the fcrew; a machine of great efficacy in raifing weights, or in preffing bodies clofely together. For if the triangle ABD be turned round a cylinder whofe periphery is equal to BD, then the length of the inclined plane BA will rife round the cylinder in a fpiral manner, and from what is called the thread of the fcrew; and we may fuppofe it continued in the fame manner round the cylinder from one end to the other; and AD the height of the inclined plane will be every where the diftance between two contiguous threads of the fcrew, which is called a convex fcrew: and a concave fcrew may be formed to fit this exactly, if an inclined plane, every way like the former, be turned round the infide of a hollow cylinder, whofe periphery is fomewhat larger than that of the other. Let us now fuppofe the concave fcrew to be fixed, and the convex one to be fitted into it, and a weight to be laid on the top of the convex fcrew: then, if a power be applied to the periphery of this convex fcrew to turn it round, at every revolution the weight will be raifed up through a fpace equal to the diftance between the two contiguous threads; that is, to the line AD the height of the inclined plane BA; therefore, fince the power applied to the periphery acts in a direction parallel to BD, it muft be to the weight it raifes as AD to BD, or as the diftance between two contiguous threads, to the periphery of the convex fcrew.

" The diftance between two contiguous threads is to be meafured by a line parallel to the axle. If we now fuppofe that a handfpike or handle, which is inferted into the bottom of the convex fcrew, and that the power which turns the fcrew is applied to the extremity of this handle, which is generally the cafe; then, as the power is removed farther from the axis of motion, its force will be fo much increafed (*vide* what was faid of the lever, *Cor.* 1.) and therefore fo much may the power itfelf be diminifhed: fo that the power, which, acting on the end of a handle, fuftains a weight by means of a fcrew, will be to that weight, as the diftance between two contiguous threads of the fcrew, to the periphery defcribed by the end of the handle. In this cafe we may confider the machines as compofed of a fcrew and a lever, or, as Sir Ifaac Newton expreffeth it, *Cuneus à vecte impulfus.*"

Of any two or more of thefe fimple machines combined together, all other machines, however complicated, are compofed; and their powers and manner of acting may thereby be explained from the principles here laid down.

MECHANICAL, in *mathematics*, denotes a conftruction of fome problem, by the affiftance of inftruments, as the duplicature of the cube, and quadrature of the circle, in contradiftinction to that which is done in an accurate and geometrical manner.

MEDICINE-CHEST, is compofed of all forts of medicines neceffary for a campaign, together with fuch chirurgical inftruments as are ufeful, fitted up in chefts, and portable.

MEMOIRS, in *military matters of literature*, a fpecies of hiftory, written by perfons who had fome fhare in the tranfactions they relate, anfwering, in fome meafure, to what the Romans call *commentarii*, i. e. commentaries.

MENSURATION, in *general*, denotes the act or art of meafuring lines, fuperficies and folids.

MERIT, in a *military ſenſe*, ſignifies promotion in the army according to merit, and not by purchaſe or intereſt.

MERLON, in *fortification*, that part of the parapet which is terminated by 2 embraſures of a battery, ſo that its height and thickneſs are the ſame with thoſe of the parapet. It ſerves to cover thoſe on the battery from the enemy, and is better when made of earth, well rammed and beat cloſe, than of ſtone, becauſe theſe fly about, and wound thoſe it ſhould defend.

MESS, in a *military ſenſe*, implies a number of ſoldiers who, by laying away a certain moiety of their pay towards proviſions, meſs together: 6 or 8 is generally the number of each meſs. Experience proves that nothing contributes more to the health of a ſoldier, than a regular and well-choſen diet, and his being obliged every day to boil the pot; it corrects drunkenneſs, and, in a great meaſure, prevents gaming, and thereby deſertion.

METAL, a hard, ſhining, mineral body, fuſible by fire, concreſcible by cold, ductile, and capable of being amalgamated or intimately united to quickſilver.

Gun-METAL, a compoſition of tin and copper. The moſt common proportion is, to 100 pounds of copper 12 pounds of tin: the founders will ſometimes vary from this proportion, according to the hardneſs of the copper.

MILE, in *geography*, a long meaſure, whereby the Engliſh, &c. uſe to expreſs the diſtance between places: it is of different extent in different countries. The geometrical mile contains 1000 geometrical paces, *mille paſſus*, from whence miles are denominated.

We ſhall here give a table of the miles in uſe among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

		Geometrical paces
Mile of	Ruſſia - -	750
	Italy - -	1000
	England - -	1200
	Scotland and Ireland	1500
The	old league of France	1500
	ſmall league of France	2000
	great league of France	3000
Mile of	Poland - -	3000
	Spain and Portugal	3428
	Germany - -	4000
	Sweden - -	5000
	Denmark - -	5010
	Hungary - -	6000
	Holland - -	3500

MILITARY, ſomething belonging to the ſoldiery or militia, &c.

MILITARY *architecture*, the ſame with fortification. See FORTIFICATION.

MILITARY *ways*, the large Roman roads which Agrippa procured to be made through the empire in Auguſtus's time, for the marching of troops and conveying of carriages. They were paved from the gates of Rome to the utmoſt limits of the empire.

MILITARY *diſcipline*. Next to the forming of troops, military diſcipline is the firſt object that preſents itſelf to our notice: it is the ſoul of all armies; and unleſs it be eſtabliſhed amongſt them with great prudence, and ſupported with unſhaken reſolution, they are no better than ſo many contemptible heaps of rabble, which are more dangerous to the very ſtate that maintains them, than even its declared enemies. See DISCIPLINE.

MILITARY *execution*, the ravaging or deſtroying of a country or town that refuſes to pay the contribution inflicted upon them.

MILITARY *firſt principles*, is the bodily training for a ſoldier, to make him hardy and robuſt, capable to maintain health amidſt fatigue, bad weather and change of climate; to march at ſuch poſſible pace, and for ſuch length of time, and with ſuch burden, as, without training, he would not be able to do.

MILITIA, in *general*, denotes the body of ſoldiers, or thoſe who make profeſſion of arms.

In a more reſtrained ſenſe, militia denotes the trained-bands of a town or country, who arm themſelves, upon a ſhort warning, for their own defence; ſo that, in this ſenſe, militia is oppoſed to regular or ſtated troops.

For the direction and command of the militia, the king conſtitutes lords-lieutenants of each county.

MILL, properly denotes a machine for grinding corn, &c. but more generally it denotes all ſuch machines whoſe action depends upon a circular motion. There are various kinds, though foreign to this work.

Gun-powder MILL, is that uſed for pounding and beating together the ingredients of which gunpowder is compoſed. See GUNPOWDER.

Theſe ingredients being duly proportioned, and put into the mortars of the mills, which are hollow pieces of wood, each capable of holding 20 pounds of paſte, are incorporated by means of the peſtle and ſpindle. There are 24 mortars in each mill, where are made each

day 480 pounds of gunpowder, care being taken to ſprinkle the ingredients in the mortars with water, from time to time, leſt they ſhould take fire. The peſtle is a piece of wood 10 feet high, and 4½ inches broad, armed at bottom with a round piece of metal. It weighs about 65 pounds.

MINE, in a *military ſenſe*, implies a ſubterraneous paſſage dug under the wall or rampart of a fortification, with a deſign of blowing it up by gunpowder.

Counter-MINES, are thoſe made by the beſieged, whereas mines are generally made by the beſiegers. Both mines and counter-mines are made in the ſame manner, and for the like purpoſes, viz. to blow up their enemies and their works; only the principal galleries and mines of the beſieged, are uſually made before the town is beſieged, and frequently at the ſame time the fortification is built, to ſave expence.

MINING, in the *art of war*, is become one of the moſt eſſential parts of the attack and defence of places: ſo much artillery is uſed, that nothing above ground can withſtand its effects; the moſt ſubſtantial ramparts and parapets can reſiſt but a ſhort time; the outworks, though numerous, ſerve only to retard, for a time, the ſurrender of the place.

Hiſtory informs us that mines were made long before the invention of gunpowder; for the ancients made galleries or under-ground paſſages, much in the ſame way as the moderns, from without, under the walls of the places, which they cut off from the foundation, and ſupported them with ſtrong props: then they filled the intervals with all manner of combuſtibles, which being ſet on fire burnt their props, and the wall being no longer ſupported fell, whereby a breach was made.

The beſieged alſo made under-ground paſſages from the town under the beſieger's machines, by which they battered the walls, to deſtroy them; which proves neceſſity to be the inventor of mines, as well as of other uſeful arts.

The firſt mines, ſince the invention of gunpowder, were in 1487, by the Genoeſe, at the attack of Serezanella, a town in Florence; but theſe failing, they were for ſome time neglected, till Peter Navarro, being then engineer to the Genoeſe, and afterwards to the Spaniards in 1503, againſt the French, at the ſiege of the caſtle del Ovo, at Naples, made a mine under the wall, and blew it up, and the caſtle was taken by ſtorm.

Mr. Valliere relates the ſame ſtory, but differs in the name of the engineer: he ſays it was Francis George, an Italian, who, ſerving at Naples in quality of architect, propoſed to Peter Navarro, the Spaniſh governor, to take this caſtle by mines.

Definitions of MINES. A mine is a ſubterraneous cavity made according to the rules of art, in which a certain quantity of powder is lodged, which by its exploſion blows up the earth above it.

1. It has been found by experiments that the figure produced by the exploſion is a *paraboloid* $ABCD$ (Pl. VII. *fig.* 6.) and that the centre of the powder, or charge, occupies the *focus* F.

2. The place where the powder is lodged is called the *chamber* of the mine, or fourneau.

3. The paſſage leading to the powder is called the *gallery*.

4. The line FC drawn from the centre F of the chamber, perpendicular to the neareſt ſurface AB of the ground, is called the line of leaſt reſiſtance.

5. The pit or hole ADB, made by ſpringing the mine, is called the *excavation*; alſo AB is the *diameter*, and CB the *radius* thereof.

6. The fire is communicated to the mines by a pipe or hoſe, made of coarſe cloth, whoſe diameter is about 1½ inch, called a *ſauciſſon*, (for the filling of which near half a pound of powder is allowed to every foot) extending from the chamber to the entrance of the gallery, to the end of which is fixed a match, that the miner who ſets fire to it may have time to retire, before it reaches the chamber.

7. To prevent the powder from contracting any dampneſs, the ſauciſſon is laid in a ſmall trough, called an *auget*, made of boards 3½ inches broad, joined together lengthwiſe, with ſtraw in it, and round the ſauciſſon, with a wooden cover nailed upon it.

$\left.\begin{array}{l}\textit{Foyer,}\\ \textit{Focus,}\text{ or}\\ \textit{Centre of the Chamber.}\end{array}\right\}$ Some authors call the end of the ſauciſſon that comes within the work, and which is to be ſet fire to, the foyer, or focus; but by moſt people, this is generally underſtood to be the centre of the chamber.

Galleries and chambers of MINES. Galleries made within the fortification, before the place is attacked, and from which ſeveral branches are carried to different places, are generally 4 or 4½ feet wide, and 5 or 5½ feet high. The earth is ſupported from falling in by arches and walls,

walls, as they are to remain for a confiderabl time; but when mines are made to be ufed in a fhort time, then the galleries are but 3 or 3½ feet wide, and 5 feet high, and the earth fupported by wooden frames or props.

The gallery being carried on to the place where the powder is to be lodged, the miners make the chamber, which is generally of a cubical form, large enough to hold the wooden box, which contains the powder neceffary for the charge: the box is lined with ftraw and fand-bags, to prevent the powder from contracting dampnefs.

The chamber is funk fomething lower than the gallery, if the foil permits; but where water is to be apprehended, it muft be made higher than the gallery; otherwife the befieged will let in the water, and fpoil the mine.

Quantities of powder to charge Mines. Before any calculation can be made of the proper charge for a mine, the denfity and tenacity of the foil it is to be made in muft be afcertained, either by experiment, or otherwife; for, in foils of the fame denfity, that which has the greateft tenacity, will require the greateft force to feparate its parts. The denfity is determined by weighing a cubic foot (or any certain quantity) of the foil; but the tenacity can only be determined by making a mine. The following table contains experiments in 6 different foils, which may be of fome affiftance to form a judgement of the nature of the foil, when an actual experiment cannot be had.

Nature of the foil	Denfity Weight of 1 cubic foot	Tenacity Quant. of powder to raife 1 cubicfathom
1. Loofe earth or fand	95 pds.	8 pds.
2. Common light foil	124	10
3. Loam, or ftrong foil	127	11½
4. Potter's clay, or ftiff foil	135	13½
5. Clay, mixed with ftones	160	16
6. Mafonry	205	21½

All the requifites in mining may be determined by the following problems, which admit of 4 cafes; for any 3 of the articles below being given, the 4th may thence be found.

1.
2.
3.
4.
The
nature of the foil;
diameter of the excavation;
line of leaft refiftance;
charge.

Problem I.

Given the nature of the foil, the diameter of the excavation, and the line of leaft refiftance, to find the charge.

Rules.

1. To the fquare of the diameter of the excavation, add the fquare of double the line of leaft refiftance, and referve the faid fum.

2. Multiply the fquare root of the referved fum by double the line of leaft refiftance, and fubtract the product from the fame fum.

3. Multiply half the remainder by the line of leaft refiftance, and 1.57 times the product, will give the folidity of the excavation.

4. The charge will then be determined from the nature of the foil, as in the following example.

Example I.

It is required to make a mine in the fecond fort of foil, mentioned in the foregoing experiments, which fhall have a line of leaft refiftance of 10 feet, and the diameter of its excavation 20 feet: what will be the proper charge?

The nature of this foil, by the table, requires 10 pounds of powder to 216 cubic feet.

Calculation.

1. The diameter of the excavation is 20, and its fquare - - -	400
Double the line of leaft refiftance is 20, and its fquare - - - -	400
Therefore the fum to be referved is -	800
2. The fquare root of 800 is 28.3 } Double the line of leaft refiftance is 20 }	566
Which leaves the remainder	234
3. Half the remainder is - - -	117
Which, multiplied by the line of leaft refiftance, - - - - -	10
Gives the product - - -	1170
Which multiplied by - - -	1.57
Gives the folidity of the excavation - - -	feet 1836.9

4. If

	feet.		lb.		feet.		lb.
4. If	216	:	10	::	1836.9	:	85, which is the charge required.

By Logarithms.

1. Diam. of excav. is = 20	1.301030	
Diameter squared is	2.602060	400
Double the line of least resistance is = 20 and its square		400
The sum to be reserved is	2.903090	800
2. Square root of sum is 28.3	1.451545	
Double the line of least resistance is = 20	1.301030	
Product to be subtracted is	2.752575	566
Remainder is - -	2.369216	234
Line of least resist. = 10	1.000000	
10 pounds of powder	1.000000	
To 216 cubic feet, *compl. arith.*	7.665546	
To which add the *constant log.*	9.894870	
And the sum is the logarithm charge required - -	1.929632 = 85lb.	

Problem II.

Given the nature of the soil, the line of least resistance, and the charge, to find the diameter of the excavation.

Rules.

1. Find the solidity of the earth to be raised, by a proportion from the nature of the soil, and multiply it by 1.27. Divide the product by the line of least resistance, and to the quotient add the square of the line of least resistance: reserve the sum.

2. Multiply the square root of the sum reserved by twice the line of least resistance, and add the product to the said sum, and from the result subtract 3 times the square of the line of least resistance; so will the square root of the remainder be the diameter of the required excavation.

Example I.

Let a mine be charged with 100 pounds of powder, in a soil which requires 11 pounds of powder to raise 216 cubic feet, and let its line of least resistance be 10 feet: what will be the diameter of the excavation?

By the nature of the soil 11lb. : 216 feet :: 100lb. : 1964 feet, which is the solidity of the earth to be raised.

1. Therefore multiply - - -	1964
By - - - - - -	1.27
The product is - - -	2494.28
Which divided by the line of least resistance, 10, is - -	249.428
To which add the square of the line of least resistance - -	100.000
And the sum to be reserved is -	349.428
2. The square root of 349.428 is 18.7, which, multiplied by twice the line of least resistance, 20, gives	374.
This added to the sum reserved gives	723.428
From which subtract 3 times the square of least resistance -	300.
And there will remain - -	423.428

The square root of which is, 20.5 feet, being the required diameter of the excavation.

By Logarithms.

	Numb.	Logar.	Numb.
Cubic feet =	216	2.334454	
Powder 11lb. *co. ar.*		8.958607	
Charge =	100	2.000000	
Line of least resist. 10 *co. ar.*		9.000000	
Constant logarithm		0.103804	
		2.396865	249.4
To which add the square of line of least resistance			100.0
Sum to be reserved is		2.543323	349.4
Half of which logar. is		1.271661	
Twice line of least resist. 20,		1.301030	
Product to be added is		2.572691	373.8
The result is - - - -			723.2
From which subtract thrice the square of the line of least resistance			300.0
And there remains		2.626546	423.2
Half of which logar. is		1.313273	20.57

feet, the diameter of the excavation required.

Demonstration by Algebra.

Let the diameter of excavation (*fig.* 6.) *AB* = *d*;

$= d$; the line of leaſt reſiſtance $FC = l$; the parameter $= p$, and $n = 1.57$; alſo the ſolid $AEGB = s$. Then will $DC = l + \frac{p}{4}$, and $p \times \overline{l + \frac{p}{4}} = \frac{d^2}{4}$, by the nature of the parobola; therefore $d = \sqrt{p \times \overline{4l + p}}$.

Alſo $n \times \overline{l + \frac{p}{4}} \times \frac{d^2}{4} =$ the ſolid $ADB = n{\cdot}p \times \overline{l + \frac{p}{4}}\big|^2$, and $\frac{np^3}{16} =$ the ſolid EDG; and the difference of theſe gives the ſolid $AEGB = np \times \overline{l + \frac{p}{4}}\big|^2 - \frac{np^3}{16} = s = np \times \overline{l^2 + \frac{pl}{2}}$; from whence $p = \sqrt{l^2 + \frac{2s}{nl}} - l$, and $4l + p = 3l + \sqrt{l^2 + \frac{2s}{nl}}$, but $d = \sqrt{p \times \overline{4l + p}} = \overline{\sqrt{l^2 + \frac{2s}{nl}} - l^2 \times \frac{2s}{nl} + \sqrt{l^2 - 3l^2}}\Big|^{\frac{1}{2}} = 2l\ \overline{\sqrt{\frac{2s}{nl} + l^2 + \frac{2s}{nl} + l^2 - 3l^2}}\Big|^{\frac{1}{2}}$, which is the rule to problem II. by putting 1.27 for its equal $\frac{2}{n}$.

Again, $s = npl \times \overline{l + \frac{p}{2}}$, as above; and $d^2 = 4pl + p^2$, from whence $p = \sqrt{4l^2 + d^2} - 2l$, which ſubſtituted for its value above, gives $s = nl \times \overline{\sqrt{4l^2 + d^2} - 2l} \times \overline{l + \frac{\sqrt{4l^2 + d^2} - 2l}{2}} = \frac{nl}{2} \times \overline{4l^2 + d^2 - 2 - 2l\sqrt{4l^2 + d^2}}$, which is the rule to problem I.

Loading and ſtopping of Mines. The gallery and chamber being ready to be loaded, a ſtrong box of wood is made of the ſize and figure of the chamber, being about 1-3d or 1-4th bigger than is required for containing the neceſſary quantity of powder: againſt the ſides and bottom of the box is put ſome ſtraw; and this ſtraw is covered over with empty ſand-bags, to prevent the powder from contracting any dampneſs: a hole is made in the ſide next the gallery, near the bottom of the sauciſſon to paſs through, which is fixed to the middle of the bottom, by means of a wooden peg, to prevent its looſening from the powder; or that, if the enemy ſhould get to the entrance, they may not be able to tear it out. This done, the powder is brought in ſand-bags, and thrown looſe in the box, and covered alſo with ſtraw and ſand-bags; upon this is put the cover of the box, preſſed down very tight with ſtrong props; and, to render them more ſecure, planks are alſo put above them, againſt the earth, and wedged in as faſt as poſſible.

This done, the vacant ſpaces between the props are filled up with ſtones and dung, and rammed in the ſtrongeſt manner: the leaſt neglect in this work will conſiderably alter the effect of the mine.

Then the auget is laid from the chamber to the entrance of the gallery, with ſome ſtraw at the bottom; and the ſauciſſon laid in it, with ſtraw over it: laſtly, it muſt be ſhut with a wooden cover nailed upon it. Great care muſt be taken, in ſtopping up the gallery, not to preſs too hard upon the auget, for fear of ſpoiling the ſauciſſon, which may hinder the powder from taking fire, and ſo prevent the mine from ſpringing. The gallery is ſtopped up with ſtones, earth and dung, well rammed, 6 or 7 feet further from the chamber than the length of the line of leaſt reſiſtance.

Table for the charge of Mines, *according to* Valliere.

Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder	
feet	lb.	oz.	feet	lb.	oz.	feet	lb.	oz.	feet	lb.	oz.
1	0	2	12	162	0	23	1140	10	34	3680	12
2	0	12	13	205	15	24	1296	0	35	4019	8
3	2	8	14	257	4	25	1558	9	36	4374	0
4	6	8	15	316	4	26	1647	12	37	4748	11
5	11	11	16	384	0	27	1815	4	38	5144	4
6	20	4	17	460	9	28	2058	0	39	5561	2
7	32	2	18	516	12	29	2286	7	40	6000	0
8	48	0	19	643	0	30	2530	4	41	6439	3
9	68	5	20	750	0	31	2792	4	42	6878	1
10	93	12	21	868	3	32	3072	0	43	7317	4
11	124	12	22	998	4	33	3369	1	44	7756	0

By

By this construction the radii of the bases being always equal to the lines of least resistance, the solids are similar, and therefore are to each other as the cubes of their axes; i. e. as the cubes of the lines of least resistance: so that, taking any one of the charges to be true, the others will be found, by saying, *As the cube of the axis, whose charge is given, is to its charge, so is the cube of the axis of any other mine to its charge.*

For example, let the charge 93¾ of the mine, whose line of least resistance is 10 feet, be given, and it be required to find the charge of any other mine, whose line of least resistance is given, suppose 15; then say, as the cube 1000 of 10, is to the cube 3375 of 15, so is the charge 93¾ to the charge required, which is 316.4, or 316lb. 6 ounces, which is 2 ounces more than in the table. In the same manner is found the charge of a mine whose line of least resistance is 20; or because 20 is double of 10, the cube of 20 will be double the cube of 10; and therefore 8 × 93¾, or 750lb. will be the charge for that mine.

Table for the charge of Mines, *according to Mr. Muller.*

Diam.	Charge	Diam.	Charge	Diam.	Charge
feet	lb.	feet	lb.	feet	lb.
22	150	42	639	62	1518
24	181	44	711	64	1621
26	2.7	46	773	66	1741
28	255	48	857	68	1842
30	297	50	946	70	1980
32	344	52	1000	72	2098
34	394	54	1115	74	2243
36	452	56	1205	76	2372
38	502	58	1299	78	2501
40	560	60	1406	80	2648

In this table the line of least resistance is supposed to be always 10 feet, and the charges producing the openings at the sides of them from 22 feet to 80. Hence, we suppose that the charge of 93¾ feet of a mine, whose line of least resistance and radius of the base are each 10 feet, are given; and from thence the rest are computed by means of these equations $KC = \sqrt{AC^2 + FC^2}$ and $p \times KC = a$ (fig. 6.): and, as we have observed, by comparing the diameters of the bases, found, by means of these equations, to be rather less than those found by experiments, it is presumed that the diameters, marked in this table, will not be found less, but rather greater, in practice.

Table *of* Cube Boxes *for the charges of* Mines, *from 50 to 640 pounds.*

Cha.	Side	Cha.	Side	Cha.	Side	Cha.	Side
50	12.5	155	18.3	255	21.5	450	26.1
55	12.9	160	18.5	260	21.7	460	26.2
60	13.3	165	18.6	270	22.0	470	26.4
65	13.6	170	18.8	280	22.2	480	26.6
70	14.0	175	19.0	290	22.5	490	26.8
75	14.3	180	19.2	300	22.8	500	27.0
80	14.6	185	19.4	310	23.0	510	27.2
85	14.9	190	19.6	320	23.3	520	27.3
90	15.2	195	19.7	330	23.5	530	27.5
95	15.5	200	19.9	340	23.7	540	27.7
100	15.8	205	20.0	350	24.0	550	27.9
105	16.0	210	20.2	360	24.2	560	28.0
110	16.3	215	20.4	370	24.4	570	28.2
120	16.8	220	20.5	380	24.6	580	28.4
125	17.0	225	20.7	390	24.8	590	28.5
130	17.2	230	20.8	400	25.0	600	28.7
135	17.4	235	21.0	410	25.3	610	28.8
140	17.6	240	21.1	420	25.5	620	29.0
145	17.8	245	21.3	430	25.7	630	29.1
150	18.0	250	21.4	440	25.9	640	29.3

A cubic foot of common powder weighs about 55lb. If we say, As 55 is to unity, so is any other quantity to its cube; that is, if the given quantity of powder be divided by 55; the quotient will be the cube required, and its cube root will be the length of the side of the cube box.

Example, to find a cube which shall hold 360lb. Divide 360 by 55; you will have 6.545 for the cube expressed in feet; and the cube root 1.875 feet, or 22.5 inches of that number, will be the length of the side of that cube.

The box must always be made ¼ bigger than it should be, on account of the straw and sand-bags put in it, to keep the powder from receiving any damage from wet; so that, if the quantity of powder be 360lb. the ¼ part of it, which is 90, must be added, and the sum 450 divided by 55, to have 8.1818, whose square root, 2.86 feet, or 35 inches, will be the side required.

Globe of compression in MINES, *from Belidor*. If you imagine a large globe of earth homogeneous in all its parts, and a certain quantity of powder lodged in its centre, so as to produce a proper effect without bursting the globe; by setting fire to the powder, it is evident, that the explosion will act all round, to overcome the obstacles which oppose its motion; and as the particles of the earth are porous, they will compress each other in proportion as the flame increases, and the capacity of the chamber increases likewise: but the particles of earth next to the chamber will communicate a part of their motion to those next to them, and those to their neighbours; and this communication will thus continue in a decreasing proportion, 'till the whole force of explosion is entirely spent; and the particles of earth beyond this term, will remain in the same state as they were at first. The particles of earth that have been acted upon by the force of explosion will compose a globe, which Mr. Belidor calls the *globe of compression*.

From several experiments with various charges, made by Mr. Belidor at la Fere, and by M. Dalencourt in Portugal, (at the latter of which I was present) it appeared, that the greatest diameter of an excavation may not only be made double, but triple or quadruple; contrary to the general opinion. From these experiments we are convinced, that the diameter of the excavation could be made greater than was imagined; but for what reason, was not hitherto known, 'till M. Belidor demonstrated it, in the Memoirs of the Academy of Sciences at Paris, in the year 1762.

To explain the reasons on which the principles of mines are grounded, it is necessary to consider, not only the resistance which the weight of the earth and the cohesion of the parts make against the force of explosion, but likewise the pression of the atmosphere, which is so great as to counterbalance a column of water of the same base, whose altitude is 33 feet, which answers nearly to a height of a middling soil of about 22 feet: so that, if the line of least resistance of a mine be 10 feet, the force of explosion must not only overcome the weight of 10 feet of earth above it, but 32 feet, properly speaking. It is, however, to be observed, that this weight resists the force of explosion no longer than 'till the mine bursts, and the explosion gets a communication with the air; because then the pressure of the air ceases.

Pl. VII. *fig.* 5. As the powder does not fire all at once, but gradually, so the force of explosion increases proportionally, and condenses the earth all round in a spheric form, 'till this force overcomes the resistance of the earth and atmosphere, which cannot happen before the earth rises in the middle in a spheric form, and the radius *CA* of explosion extends to the surface *AB* of the earth; and then the explosion, getting a free communication with the air, raises the earth to a considerable height, and forms an excavation of a curve-lined figure, such as *AEB*. The point *C* represents the centre of the powder or chamber.

It is a known principle, established by facts, that the force of explosion is always proportional to the quantity of powder fired; and as the force of explosion acts in a spheric form, and spheres are as the cubes of their radii, it is evident, that the forces of explosion, or the quantities of powder fired, are proportional to the cubes of their radii.

This proportion will always hold good in an uniform soil, but varies according to the density: and if the chamber of a mine be placed in a rock, or some other hard substance, the diameter of the excavation will be greater than it would have been otherwise; because the force of explosion, being resisted downwards, will act with more violence towards the sides, and upwards. A mine, placed in a soil of a greater density and tenacity than another of the same depth, requires a greater charge in proportion; but it must be observed, that the tenacity is not proportional to the surface of the excavation, as M. de Valliere and some others pretend, but to the solid itself, as explained in M. Muller's treatise on mines.

 To

To find a proper charge for a mine in any soil, so as to produce a given diameter, an experiment mine must be made in the same soil, sufficiently charged, so as to produce a proper effect, and the line of least resistance exactly measured, as well as the diameter of the opening, by which the radius CA of the globe of compression will be found: then say, *The cube of the radius of the globe of compression found by the experiment, is to the cube of the radius of the proposed mine, as the charge of the experiment mine is to the charge required.*

And to find the diameter of the mine whose charge is given, say, *The charge of the experiment mine, is to the given charge, as the cube of the radius of the first, is to the cube of the radius of the second.* From whence the diameter required is found by this equation, $CA^2 - CD^2 = AD^2$.

We have hitherto computed the diameters of mines from their charges; we shall now give some examples how to find the charges from the given diameters. Thus, a mine, made in the same soil above mentioned, whose line of least resistance is 10 feet, it is required to find the charge so as to make a diameter of 40 feet: the sum of the squares of the line of least resistance 10, and ½ the diameter 20, gives 500 for the square of the radius of the globe of compression; and the square root 22.36 of 500, multiplied by 500, gives 11180, for the globe of compression: then the globe of compression 4412 of the second mine, is to the globe of compression 11180, as the charge 160 of the experiment mine, is to the charge required, which will be 405lb. nearly. Again, let a mine, whose line of least resistance is 10 feet, be loaded with 170lb. of powder, having a diameter of 20 feet: it is proposed to make another in the same soil, whose line of least resistance is 15 feet, and diameter 70. To find its charge, say, the square 12·5 of ½ the diameter 70, added to the square 225 of the line of least resistance 10, gives 1450, whose root is 38 nearly; and 1450, multiplied by 38, gives 55100 for the globe of compression; and as the globe of compression of the experiment mine, has been found above to be 2828, we have 2828 : 55100 :: 170 : 3312 lb. of powder for the charge required.

We will now show the application of the globe of compression in the defence of places, and profiles of countermines made at la Fere, and also at the famous siege of Schweidnitz in 1762. Pl. VII. *fig.* 7, 8, 9. The first chamber *C* blew up two 24-pounders towards the trenches: the battery being re-established, the chamber *D* threw the guns into the ditch: the batteries being re-established again, the chamber *E* threw the artillery again into the ditch, to the great surprise of the spectators, some of whom expected quite the contrary.

In 1764, a battery was raised in all its forms at Potsdam, by major Le Fevre, engineer in the Prussian service, for two 24-pounders: under the middle of which a gallery, *fig.* 10. 11. was made from the foot *T* of the banquet, of 20 feet long; from which two branches, *G H*, *G I*, were made, each of 8 feet long, to place the chambers *A*, *A*, whose line of least resistance was 7 feet only, and exactly under the axle-trees of the guns: the gallery was continued in a slope, to form 2 other branches, *K L*, *N K*, in the same manner as the preceding ones, but lower, to place the chambers *B*, *B*, whose line of least resistance was 10 feet, and at the same distance from the former *A*, taken horizontally, in order to have the right-angled isosceles triangle *B D C*, *fig.* 10, whose hypothenuse, *B C*, shows the direction of the action of the powder.

The intent of little chambers, *A A*, being to overcome the tenacity of the soil, without any other effect, were charged each with 20lb. of powder only; whereas the others, *B B*, were each loaded with 600 lb. The length of the leaders was so contrived, as to set fire to *F*, then to *G*, and from thence to the chambers *A A*, and to the point *K*, at the same time; also to the chambers *B B*, in a few seconds afterwards. The first, *A A*, having produced a proper effect, the second, *B B*, met with less resistance towards the wheels of the carriages than towards the trail, raised the pieces about 240 feet, and then threw them 210 feet from the battery into the ditch.

Though the centres of the two chambers were 18 feet from each other, yet they produced but one excavation, of an elliptic form, whose greatest diameter was 45 feet, and the least 27, the depth 18, the bottom well cleared, without hurting the parapet of the covert-way. If then two mines produced so great an excavation, to what extremity will the besiegers be reduced, if a battery of 10 or 12 pieces of artillery was blown up? for where will they find earth to fill up an excavation of 210 or 240 feet in length, and from 15 to 18 feet deep? What time will be lost in repairing all these damages! and what destruction must there be amongst the soldiers, from the fire of shells, carcasses, and grenades, continually thrown into such a confined place!

In 1753, the French king gave orders for some experiments to be made at Bisy, to render useless

less the countermines of a besieged town, by bursting the galleries all round, above and below, to a certain distance; or to change these galleries into so many trenches, by which the covert-way may be taken at once, with very little trouble. The work begun with what belongs to the globe of compression. A soil had been fixed upon, the most uniform that could be found, which happened to be a hard sand, mixed with gravel. Four galleries were made, *A, B, C, D* (Pl. XIII. *fig.* 7.) 3 feet wide, and 6 feet high, so as to form a rectangle, whose sides answered nearly to the four cardinal points: the two opposite ones, *A, B,* which faced the north and south, were each 60 feet long, and the other two, *C, D,* which faced the east and west, 72 feet: they were lined with stones, in order to show that masonry was rather an advantage, than an obstacle to the effects of powder. The bottom of these galleries had a slope of 6 feet 3 inches, and the mean depth was 15 feet under the surface of the ground, which terminated in a descent from south to north, between the interval of the galleries of that name. In that to the east *C,* a branch, *L K,* was made at right angles, of 24 feet long, and at *K* another, *K F,* at right angles to this, to place a chamber, *E,* 30 feet from the gallery *A,* 36 from *D,* and 42 from *B.* The other galleries were made by means of 2 shafts, or pits, *M, I:* the one, *M,* to the south, was 16 feet deep, and the other, *I,* to the north, 20.

When these galleries were finished, the last shaft *I,* was deepened 9 feet more; so that the bottom *Y,* (*fig.* 8.) was 29 feet below the surface of the ground, near the chamber. After this a gallery *Y X,* was made, going directly under the chamber *E,* with a descent of 18 inches, and 5 feet high; by which its top was 14 feet below the centre of the chamber *E*: the whole supported with strong oak planks, and still in the same sort of soil as mentioned before, but so hard, that the miners were obliged to use their chissels. Such was the disposition belonging to the globe of compression; whose object was, to see whether it would burst all these galleries. The globe of compression, which had been charged only 24 hours with 3000lb. of powder, was set fire to on the 18th of June, 1753, in the presence of several officers, and other persons of quality; when it raised the earth about 150 feet high. They then went to see whether it had destroyed the galleries about it, and to what distance the globe of compression had acted. It was found that it formed an excavation perfectly round, of 66 feet diameter, and 17 deep.

The east gallery *C,* lined with masonry, at 24 feet distance from the chamber, was entirely burst from one end to the other.

The south gallery *A,* at 30 feet distance from the chamber, was equally burst from end to end, excepting 12 feet near the entrance *M,* at the west.

The west gallery *D,* of 72 feet long, and 36 distant from the chamber, was destroyed to the length of 42 feet: 18 feet were left near its entrance at the north, and 12 feet at the other end.

The north gallery *B,* which was 60 feet long, and 42 from the chamber, was destroyed all but 12 feet at its entrance, at the west: so there was 48 feet impracticable, which were divided into 2 equal parts by the perpendicular drawn from the centre of the chamber of that gallery. As that line formed a right-angled triangle, with ½ the gallery destroyed, whose hypothenuse is 48 feet, which hypothenuse is the radius of the globe of compression; this shows that it would have destroyed a gallery at that distance, and consequently quadruple the line of least resistance.

The gallery *Y, X, S,* (*fig.* 8.) which passed under the chamber *E,* whose top was 14 feet from it, and length 69, could not be entered farther than the length, *Y Z,* of 24 feet, so that 45 feet of it was destroyed: as the extremity of this gallery was 9 feet beyond the centre of the chamber, it appears, that there remain 60 feet from the middle to the entrance; and as there were 24 feet not destroyed, there remained 36 destroyed on that side, which being taken for the base of a right-angled triangle, *Z S E,* and the perpendicular, *E S,* being 14 feet, the hypothenuse, *E Z,* is found to be 38 feet, which is the radius of the globe of compression: so that it would have destroyed a gallery whose top had been at that distance under the mine, consequently 50 feet under the surface of the ground, which is the greatest distance that a gallery can ever be made. From hence it follows, that if the line of least resistance had been 15 or 16 feet, instead of 12, the globe of compression would have destroyed a gallery of 60 feet distant from the chamber; consequently, if the chamber was placed at that depth, and nearly in the middle between 2 listening galleries, whose distance is generally from 90 to 144 feet, it would have bursted both the envelope, and all those under and above them, by increasing the quantity of powder in proportion. This proves the great use that may be made of the globe of compression in the attack of a place countermined.

Pl. XIII.

Pl. XIII. *fig*. 17. To apply this method of attacking the countermines in a place besieged, we supposed the first and second parallels made the latter *A*, *B*, *C*, distant about 360 feet from the palisades of the covert-way; and from thence the trenches are carried on in the capital of the ravelin, and in those of the adjacent bastions of the front attacked; and after this, batteries, *L*, are made of cannons and mortars, to enfilade by ricochet the covert-way and the ramparts parallel to it, to destroy their defences. During this time, the sappers carry on the saps towards the places of arms in the covert-way, both salient and re-entering; to establish the heads *E T*, near the ends of the listeners, *G*, *G*, before the salient angles; and the miners proceed under ground to place chambers *I*, overcharged, between the extremities of the listeners of the re-entering angles. We suppose they have taken the precaution to sink their shafts as deep as the countermines; that the chambers may nearly be upon a level with the galleries; and that the shafts are placed in the trenches, *K*, which lead from one battery to the other, not to interfere with any other works. From the bottom of these shafts they make the galleries, *KL*, of about 120 feet long. This will be a work of about 4 or 5 days to the establishing their chambers, which should be finished at the same time, that they may be sprung together: by this time the sappers will be got to the heads *E F*, to induce the besieged to spring some of their mines, to destroy them.

Supposing that they have sprung 2 or 3 mines at each side, as soon as this is done, the miners enter into the excavations to discover the galleries; which they must do at the same time, while the sappers form a lodgment in the excavation. When the galleries are found and cleared, they stop up their entrances, to keep in the smoke, 'till they want to make use of them. On the other hand, all the globes of compression are fired, and from their excavations search is made on the right and left to discover the *listners*; so that, if the measures have been rightly taken, 14 entrances into the countermines will be found, by which it will be out of the power of the besieged to resist equally every where: should there be but half that number practicable, it would be sufficient to get possession of all their mines; of which only those that are convenient to advance the siege, are to be changed into trenches.

Fig. 18, and 19, show the disposition of the chambers of countermines, in a profile parallel to the covert-way, and in a profile perpendicular to the same.

At the siege of Schweidnitz, in 1762, three globes of compression were sprung; every one of which answered beyond expectation.

MINERS, in a *military sense*, are generally soldiers: most of the foreign regiments of artillery have each a company of miners, commanded by a captain and 2 lieutenants. When the miners are at work in the mines, they wear a kind of hood, to keep the earth that falls, out of their eyes. In the English service, artillery soldiers are commanded for that purpose.

MINERS *tools*, consist in several sorts of spades, wheel-barrows, axes, hand-levers, chissels, sounding-augres, sledge-hammers, masons hammers, mattocks, augets, plummets, miners rule, and miners dial, &c.

Different sorts of MINES, *are as follow:*

Fougasses, are a sort of small mines, frequently made before the weakest parts of a fortification, as the salient angles and faces, not defended by a cross fire.

Treffle-MINES, are mines with two chambers only.

T-MINES, so called from the great resemblance of that letter. They are double mines, having four lodgments.

Double T-MINE, has eight lodgments, and four doors.

Triple T-MINE, has twelve lodgments, and six doors.

Double Treffle-MINE, has four lodgments, and eight doors.

Triple Treffle-MINE, has six lodgments, and twelve doors.

MINION, a piece of ordnance, formerly so called, of which were two sorts, the large and small; answering to our present 6-pounders. See CANNON.

MINUTE, in *military affairs*, the 60th part of a degree; and, in *computation of time*, the 60th part of an hour: it also denotes a short memoir or hasty sketch taken of any thing in writing.

MOAT, in *fortification*. See DITCH.

MOINEAU, a French term for a little flat bastion, raised upon a re-entering angle, before a curtain which is too long, between two other bastions. It is commonly joined to the curtain, but sometimes separated by a fosse, and then called a detached bastion. They are not raised so high as the works of the place.

MOUNT-PAG-NOTE, or *post of the invulnerable*, an eminence chosen out of cannon-shot of the place besieged.

MORASS, in *military drawings*, denotes moor,

moor, marſhy, or fenny low grounds, on which waters are lodged.

MORTARS, are a kind of ſhort cannon, of a large bore, with chambers: they are made of braſs or iron. Their uſe is to throw hollow ſhells, filled with powder; which, falling on any building, or into the works of a fortification, burſt, and their fragments deſtroy every thing within reach. Carcaſſes are alſo thrown out of them, which are a ſort of ſhells, with 5 holes, filled with pitch and other combuſtibles, in order to ſet buildings on fire; and ſometimes baſkets full of ſtones, the ſize of a man's fiſt, are thrown out of them upon an enemy, placed in the covert-way in the time of a ſiege. Of late, the very ingenious general Deſaguliers has contrived to throw bags, filled with grape-ſhot, containing, in each bag, from 400 to 600 ſhot of different dimenſions, out of mortars; the effect of which is ſo very awful and tremendous to troops forming the line of battle, paſſing a defile, or landing, &c. pouring down ſhot, not unlike a ſhower of hail, on a circumference of above 300 feet. They are diſtinguiſhed chiefly by the diameter of the bore. For example, a 13-inch mortar is that, the diameter of whoſe bore is 13 inches. There are ſome of 10 and 8-inch diameters; and ſome of a ſmaller ſort, as cohorns of 4.6 inches, and royals of 5.8 inches. See Pl. XIII. *fig.* 5.

All Engliſh mortars are fixed to an angle of 45 degrees, and cuſtom has prevailed to laſh them ſtrongly with ropes to that elevation. In a ſiege, ſhells ſhould never be thrown with an angle of 45 degrees, excepting one caſe only; that is, when the battery is ſo far off that they cannot otherwiſe reach the works: for when ſhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they cauſe to the troops, is much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines, or any other buildings, with an intention to deſtroy them, the mortars ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall, and conſequently do more execution. We are the only nation that fix mortars to an elevation of 45 degrees.

The uſe of mortars is thought to be older than that of cannon; for they were employed in the wars of Italy to throw balls of red-hot iron, and ſtones, long before the invention of ſhells. It is generally believed the Germans were the firſt inventors, and that they were actually uſed at the ſiege of Naples, under the reign of Charles VIII. in 1435. Hiſtory informs us, with more certainty, that ſhells were thrown out of mortars at the ſiege of Wachtendonk, in Gelderland, in 1588, by the earl of Mansfield. Shells were firſt invented by an unfortunate accident, by a citizen of Venlo, who, on a feſtival, celebrated in honour of the duke of Cleve, threw a certain number, one of which fell on a houſe, and ſet fire to it; by which misfortune the greateſt part of the city was reduced to aſhes. Mr. Malter, an Engliſh engineer, firſt taught the French the art of throwing ſhells, which they firſt practiſed at the ſiege of Motte, in 1634. The method of throwing red-hot balls out of mortars, was firſt put in practice, with certainty, at the ſiege of Straalſund, in 1675, by the elector of Brandenburg; though ſome ſay in 1653, at the ſiege of Bremen.

Land-MORTARS, are thoſe uſed in ſieges, and of late in battles, mounted on beds; and both mortar and bed are tranſported on block-carriages. There is likewiſe a kind of land-mortars, mounted on travelling-carriages, invented by count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes.

Partridge-MORTAR, is a common mortar, ſurrounded by 13 other little mortars, bored round its circumference in the body of its metal. The centre one is loaded with a ſhell, and the others with grenades. The vent of the large mortar being fired, communicates its fire to the ſmall ones; ſo that both ſhell and grenades go off at once. The French uſed them in the war of 1701, and more eſpecially at the ſiege of Liſle, in 1708, and at the defence of Bouchain, in 1702.

Hand-MORTARS, frequently uſed before the invention of coehorns. They were fixed at the end of a ſtaff of 4½ feet long, the other end being ſhod with iron to ſtick in the ground: while the bombardier, with one hand, elevates it at pleaſure, he with the other hand fires.

Firelock-MORTARS, } are ſmall mortars, fixed
Bombards, } at the end of a firelock: they are loaded as all common firelocks are; and the grenade, placed in the mortar at the end of the barrel, is diſcharged by a flint-lock; and, to prevent the recoil hurting the bombarbier, the bombard reſts on a kind of halberd, made for that purpoſe. They were firſt invented by major-general Siebach, a German, about the year 1740.

Names

Names of the several parts of a MORTAR.

	The	
A. B.	whole length of the mortar	Grand divisions exterior.
A. C.	muzzle	
C. D.	chace	
D. E.	reinforce	
E. F.	breech	
G. H.	trunnions	
a.	vent	Small divisions exterior.
b.	dolphins	
c. d.	vent astragal and fillets	
d. e.	breech ring and ogee	
f. g.	reinforce ring and ogee	
g. h.	reinforce astragal and fillets	
i. k.	muzzle astragal and fillets	
k. l.	muzzle ring and ogee	
l. m.	muzzle mouldings	
n.	shoulders	

	The	
o.	chamber	Interior parts.
p.	bore	
q.	mouth	
r.	vent	

Chamber in MORTARS, is the place where the powder is lodged: they are of different sorts, and made variously by different nations. The Spaniards use chiefly the spheric; the French, Germans, and Dutch, the conic, cylindric, and the concave or bottled; the Portuguese, at present, the parabolic; and the English make them in the form of a frustum of a cone. Each nation has its reasons, good or bad, to prefer their make before that of others: among which, we are of opinion that the concave and cylindric chambers are the best.

Dimensions of brass land MORTARS, *now in use.*

Diameter of the bore	13 inch.	10 inch.	8 inch.	5.8 royal	4.5 cohorn
Total length of the mortar	44.	33.	25.5	16.5	13.5
From the mouth to the reinforce	15.25	10.	8.5	4.75	4.2
Length of the reinforce	8.75	8.1	5.	5.	3.9
Length of the trunnions	7.15	6.3	5.	2.75	2.15
Length of the trunnions from end to end	35.5	26.	20.	12.	9.2
Length of the bore	24.	18.	13.	8.5	7.
Length of the chamber	6.6	4.5	4.	3.	2.7
Greatest diameter of the chamber	6.6.	4.5	4.	3.	2.7
Least diameter of the chamber	6.	3.6	3.4	2.4	1.4
Diameter of the muzzle ring	21.	15.15	11.2	8.	6.4
Breadth of the muzzle ring	1.1	.8	.6	.7	.5
Breadth of astragals and fillets	1.25	1.	.75		
Distant from the muzzle ring	1.5	1.	1.		
Diameter near the muzzle astragal	18.1	13.2	10.	6.9	5.6
Diameter near the reinforce	18.1	13.2	10.	6.9	5.6
Diameter of the reinforce	21.	15.15	15.1	8.	6.4
Breadth of the ogees	1.5	1.	1.		
Diameter behind the breach astragal	18.1	13.2	9.8	6.9	5.9

The dimensions in the above table are expressed in inches.

Weight

*Weight of Land-*MORTARS *and shells; together with the quantity of powder the chambers hold when full; the weight of the shells, and powder for loading them.*

Nature of mortars -	13-inch mortar.	10-inch mortar.	8-inch mortar.	5.8-inch royal.	4.5-inch coehorn.
Mortar's weight C.	25 0 0	10 2 18	4 0 20	1 0 0	0 3 0
Shell's weight C.	1 2 25	0 3 2	0 1 17	0 0 13	0 0 7
Shell cont. powder lb.	9 4 8	4 14 12	3 8	1 1 8	0 8 0
Chamb. cont. powd. lb.	9 1 8	4 0 0	2 0 10	1 0 10	0 8 0

The dimensions in this table are expressed, where the C. stands, in hundreds, quarters, and pounds; and where lb. stands, in pounds ounces, and grains.

Land MORTAR-BEDS, are made of solid timber, consisting generally of 4 pieces, those of the royal and coehorn excepted, which are but one single block. Their uses are to mount the land-mortars on them, for actual service; and they are well secured with iron-work, &c.

Dimensions of present Land MORTAR-BEDS, *in inches.* See Pl. IV. fig. 1. and 2.

Nature of beds		13	10	8	5.8	4.6
Lower bed	length	84.	66.	50.	0.	0.
	breadth	33.	20.	0.	0.	0.
	height	13.	10.	9.	0.	0.
Upper bed	length	83.	65.	49.	31.5	28.5
	breadth	32.	25.	19.	16.	14.
	height	13.	12.	11.	10.	9.
Breadth quarter round		3.	2.5	2.5	0.	0.
Of the ogee and fillet		4.	3.5	3.	0.	0.
Length of the cavity		20.	16.	12.	8.	5.7
Trun. holes from fore end		31.	20.	15.5	13 3	11.7
Diameter of trun. holes		7.2	6.4	5.4	3.4	2.4
Depth of trun. holes		7.	6.	5.	3.2	2.2

Names and number of iron-work, in a 13, 10, *and* 8-*inch* MORTAR-BED.

a.	Cap-squares	2
b.	Eye-bolts	2
c.	Joint-bolts	2
d.	Under and upper bed-bolts	9
e.	Dowel-bars	4
g.	Rings with bolts	4
h.	Reverse bars	2
k.	End riveting-plates	2
l.	Middle plate	1
m.	Riveting bolts	6
n.	Square riveting bolts	12
p.	Traversing bolts	6
q.	Keys, chains, and staples	2

Names

Names and number of iron-work in a royal and coehorn Mortar-Bed.

a.	Cap-ſquares	2
b.	Eye-bolts	2
c.	Joint-bolts	2
d.	Riveting-bolt, with ring	1
f.	Handles, with ſtarts	2
g.	Square riveting-plates	5
h.	Keys, chains, and ſtaples	2

Sea-Mortars, are thoſe which are fixed in the bomb-veſſels, for bombarding of places by ſea: they are made ſomewhat longer, and much heavier, than the land-mortars.

Dimenſions of Sea-Mortars, 13 *and* 10 *inches.*

Diameter of the bore divided into	30	30
Length of the bore	75	75
Diameter of the chamber	15	15
Length of the chamber	33	33
From the end of the chamber to the end of the mortar	20	20
Total length of the mortar	128	128
From the muzzle *a* to the reinforce *b*	43	43
Length of the reinforce *b c*	28	28
Thickneſs of the metal at the muzzle, mouldings excepted	8	7
Thickneſs of metal near the reinforce	9	8
Thickneſs of metal at the reinforce	10	9
Thickneſs of metal at the chamber	16	16
Breadth of the muzzle-ring and fillets	4	4
Breadth of the ogee next to it, and of that before the reinforce	3	3
Diſtance from the ogee to the muzzle-aſtragal	6	6
Breadth of the aſtragal and fillets	3	3
Breadth of the ogee behind the reinf.	4	4
The muzzle-ring projects the metal by	1.5	1.5
Diameter of the trunnions	18	18
Length of the trunnions from the mortar	20	20
	d	*d*
The content of the chamber	126	126
Weight of the metal	2.1*d*	1.8*d*

Weight of Sea-Mortars *and ſhells; with the quantity of powder to fill the ſhells and chambers.*

Diameter of the bore	13-inch mortar			10-inch mortar		
Weight of preſent ſea-mortars - - - C.	81	1	18	32	3	7
Weight of ſhells - C.	1	2	25	0	3	2
Chamb. contains pow. lb.	32	0	0	12	8	c
Shell contains powder lb.	9	4	8	4	14	12

It has been very juſtly obſerved, that the breech of our 13-inch ſea-mortars is loaded with an unneceſſary weight of metal. The chamber thereof contains 32 pounds of powder; and at the ſame time they are never charged with more than 12 or 15 pounds, becauſe the bomb-ketch is unable to bear the violent ſhock of their full charge. Thus the action of the powder is diminiſhed by the vacancy left in the chamber.

Land-Mortar-Beds, are made of very ſolid timber, and placed upon very ſtrong timber frames, fixed in the bomb-ketch; to which a pintle is fixed, ſo as the bed may turn round. The fore part of theſe beds is an arc of a circle, deſcribed from the ſame centre as the pintle-hole. The plans, elevations, and ſections, ſhow, in a diſtinct manner, the ſeveral parts of the beds. See Pl. V.

Dimenſions of Sea-Mortar-Beds, *of* 13 *and* 10 *inches.*

Length of the bed	94	84
Breadth of the bed	54	47
Height of the bed	27	23
Pintle-hole from the fore-end	39	32
Diameter of the pintle-hole	6.5	.5
Trunnions from the fore-end	46	42.5
Diameter of trunnion-holes	10	8
Depth of trunnion-holes	8	5
Diameter of the circular bed	59	59
Height of the circular bed	8	6
Diſtance to the bed-bolſter	15	16
Depth of the cavity	15	12
Its opening above	30	21
Bed-bolſter length	53	44
Length below	29	2.1
Its height	16	17
Its breadth	14	12

Iron-work of Sea-Mortar-Beds.

a.	Cap-ſquares	2
b.	Eye bolts	6
c.	Loop bolts	4
d.	Traverſing bolts	4
e.	Middle-plate	1
f.	Riveting-plates	1
g.	Riveting-bolts	6
h.	Croſs-bed bolts	7
l.	Square riveting-plates for ditto	7
k.	Down-bed bolts	15
m.	Bed-bolſter plates	2
	Keys, chains, and ſtaples	6
	Nails to the bed-bolſter bed	4
	Bed-bolſter rings and loops	2

Stone-Mortars, ſerve to throw ſtones into the

the enemy's works, when near at hand; ſuch as from the town into the trenches in the covert-way, or upon the glacis; and from theſe trenches into the town. The bore is terminated by two quadrants of a circle, terminated by the reinforce and lines drawn from the ends of the cylinder, made to lodge the tompions parallel to the axis of the mortar. The bottom of the conic chamber is terminated by an arc of 60 degrees, and the round part of the outſide is a ſemi-circle.

Dimenſions of Stone-MORTARS.		Parts
Diameter of the bore divided into		30
Length of the	bore	37
	chamber	16
Its greateſt diameter		8
Its leaſt diameter		6
Diameter of the cylindric part to hold a wooden tompion		14
Depth or axis of that cylinder		3
From the muzzle to the reinforce		20.5
Length of the reinforce		8
Thickneſs of metal at the	muzzle	3.5
	reinforce	4.5
	chamber-belt	9
	entrance of the chamber	6
The chamber enters into the trunnions by		2
Diameter of the trunnions		40
Length from end to end of the trunnions		40
Breadth of the	muzzle-ring and fillets	3
	chamber-belt	2
	ogee next to the belt	3
Content of the chamber		$\frac{d}{1102}$
Weight of metal in this mortar		$\frac{d}{3.1}$

The weight of a 13-inch ſtone mortar is 10 3 4, and the chamber contains 3 pounds of powder.

Chambers in MORTARS, are of different ſorts and dimenſions. Mr. Belidor mentions four; namely, the cylindric, the ſpheric, the conic, and the concave or bottled; to which a fifth may be added, the parabolic, invented by count de Lippe Buckeburg.

Cylindric chambers. This kind of chamber is, in our opinion, for all kind of mortars under a 13-inch diameter, the beſt. They are the only kind of chambers that may be conveniently loaded with cartridges. Though experience demonſtrates that concave chambers will throw the ſhell fartheſt of any with the ſame charge; yet, in this caſe, where but little powder is required, their entrance would become too narrow, and conſequently inconvenient to clean; whereas, when they are cylindric, the difference between the advantages of the one and the other will be but little, and not attended with any inconveniences.

Conic chambers, are generally made in a circular form at the bottom, ſo that the ſides produced, meet the extremities of the diameter at the mouth; it being imagined, I ſuppoſe, that the powder acts in right lines parallel to the ſides of the chamber; but, as that is not the caſe, we conclude, contrary to Belidor and others, that the conic chambers are the worſt of all.

Spheric chambers, are much inferior to the cylindric or concave; for it is well known by the properties of geometry, that when a cylinder and a fruſtum of a cone occupy equal ſpaces, the ſurface of the cone is always greater than that of the cylinder. Hence, if the entrance of theſe chambers be not made very narrow, contrary to practice, as demonſtrated by Mr. Muller, in his ſecond edition of Artillery, page 38 of the introduction, and the examples that follow, we conclude that theſe and the conic chambers are the worſt.

Concave chambers. The advantage of theſe kinds of chambers conſiſts in this, that their entrance may be made narrower than thoſe of any other form; and practice has ſufficiently proved it: yet, when the entrance is ſo ſmall as not to admit a man's hand, they are not eaſily cleaned; for which reaſon all 13 and 10-inch mortars ſhould have concave chambers, and the others cylindric ones.

Parabolic chambers. Theſe chambers, being the wideſt of any, may therefore be included among the worſt; as it is not the inward figure of the chamber, but its entrance, which produces the effect; becauſe the ſmaller it is, the nearer it reduces the effect into the direction of the ſhell. It has however one advantage; namely, that the ſhells will have no windage. See *dimenſions of mortars*, at the word MORTAR. See alſo VENTS.

MORTAR, in *military architecture*, a compoſition of lime, ſand, &c. mixed up with water, that ſerves as a cement to bind the ſtones, &c. of any building. Fine ſand makes weak mortar, and the rounder the ſand, the ſtronger the mortar; and if the ſand is waſhed before it is mixed, ſo much the better.

The proportion of lime and ſand for making of mortar is extremely variable. Some uſe three parts of pit-ſand, and two of river-ſand, to one of lime; others, a proportion of ſand to quick-lime as 36 to 35. It ſhould be

well mixed, and beat every 24 hours for a week together, letting it then lie for a week more; and when it is used, must be beat and mixed again. By this means it will make good mortar, though the lime is but indifferent.

Mortar *for water-courses, cisterns*, &c. is made of lime and hog's-lard; sometimes mixed with the juice of figs, and sometimes with liquid pitch, which is first slaked with wine; and, after application, it is washed over with linseed-oil.

Mortar *for furnaces*, &c. is made with red clay wrought in water, wherein horse-dung and chimney-soot have been steeped; by which a salt is communicated to the water, that binds the clay, and makes it fit to endure the fire. The clay should not be too fat, lest it should be subject to chinks; nor too lean or sandy, lest it should not bind enough.

Mortar, made of terras, pozolana, tile-dust, or cinders, is mixed and prepared in the same manner as common mortar; only these ingredients are mixed with lime instead of sand in a due proportion, which is to be in equal quantities. As this mortar is to be used in aquatic buildings, the lime should be the very best.

In fortifications, docks, or piers of harbours, I would lay all the works under water with terras-mortar, and the rest of the facings, both within and without, with cinder or tile-dust mortar, for about two feet deep.

MOTION, is defined to be the continued and successive change of place. There are three general laws of motion: 1. That a body always perseveres in its state of rest, or of uniform motion in a right line, till by some external force it be made to change its place: for a body is passive in receiving its motion, and the direction of its motion, so it retains them without any change, 'till it be acted on by something external. 2. The second general law of motion is, that the change of motion is proportional to the force impressed, and is produced in the right line in which that force acts. 3. The third general law of motion is, that action and reaction are equal, with opposite directions, and are to be estimated always in the same right line.

Motion *of an army*, the several marches and counter-marches it makes, or the changing of its post for an advantageous encampment, either with a design to besiege a place, to engage the enemy, or shun fighting, &c. See March.

Motion *of a shell or shot*. See Projectiles.

MOULDS, for casting shot for guns, muskets, carbines, and pistols: the first are of iron, used by the founders, and the others by the artillery in the field, and in garrison.

Laboratory-Moulds, are made of wood, for filling and driving all sorts of rockets, and cartridges, &c.

MOULDINGS, *of a gun or mortar*, are all the eminent parts, as squares or rounds, which serve for ornaments; such as the breech-mouldings. The rings, &c. are also called mouldings.

MOUND, in *old military books*, is a term used for a bank or rampart, or other defence, particularly that of earth.

MOUNT-*guard*. See Guard.

Mounting, in *military affairs*, signifies going upon duty: thus mounting a breech, is taking possession thereof; mounting guard, mounting the trenches, is going upon duty in those places; but mounting a gun, mortar, or howitzer, is placing them on their carriages or beds.

MOVEMENTS. See Motions *of an army*.

MOVEABLE-*Towers*. See Towers.

MULTANGULAR, is said of a figure, or body, which has many angles.

MUNITION, the provisions with which a place is furnished in order for defence, or which follow a camp for its subsistence. See Ammunition.

MURAL-*Crown*. See Crown.

MURDRESSES, in *ancient fortification*, a sort of battlement with interstices, raised on the tops of towers to fire through.

MUSKET, } the most useful and commodious fire-arm used by an army.
MUSQUET, }

They carry a ball of 29 to 2 pounds. Its length is 3 feet 8 inches from the muzzle to the pan. The Spaniards were the first who armed part of their foot with muskets. At first they were made very heavy, and could not be fired without a rest: they had match-locks, and did execution at a great distance. These kinds of muskets and rests were used in England so late as the beginning of the civil wars.

Muskets were first used at the siege of Rhege, in the year 1521.

MUSKETEERS, soldiers armed with muskets; who, on a march, carried only their rests and ammunition, and had boys to bear their muskets after them. They were very slow in loading, not only by reason of the unwieldiness of the pieces, and because they carried the powder and ball separate, but from the time it took to prepare and adjust the match: so that their

fire was not near so brisk as ours is now. Afterwards a lighter kind of match-lock musket came in use; and they carried their ammunition in bandeliers, to which were hung several little cases of wood, covered with leather, each containing a charge of powder: the balls they carried loose in a pouch, and a priming-horn hanging by their side. These arms were, about the beginning of this century, universally disused in Europe, and the troops were armed with firelocks.

MUSKET-*baskets*. See BASKETS OF EARTH.

MUSKETOON, a kind of short thick musket, whose bore is the 38th part of its length: it carries 5 ounces of iron, or 7½ of lead, with an equal quantity of powder. This is the shortest sort of blunderbusses.

MUSTER, in a *military sense*, a review of troops under arms, to see if they be complete, and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

MUSTER-*master-general*, *Commissary-general of the* MUSTERS, } one who takes account of every regiment, their number, horses, arms, &c. reviews them, sees the horses be well mounted, and all the men well armed and accoutred, &c.

MUSTER-*rolls*, lists of soldiers in each company, troop, or regiment, by which they are paid, and the strength of the army is known.

MUTINY, in a *military sense*, to rise against authority. "Any officer or soldier who shall presume to use traiterous or disrespectful words against the sacred person of his majesty, or any of the royal family, is guilty of mutiny.

"Any officer or soldier who shall behave himself with contempt or disrespect towards the general or other commander in chief of our forces, or shall speak words tending to their hurt or dishonour, is guilty of mutiny.

"Any officer or soldier who shall begin, excite, cause, or join, in any mutiny or sedition, in the troop, company, or regiment, to which he belongs, or in any other troop, or company, in our service, or on any party, post, detachment, or guard, on any pretence whatsoever, is guilty of mutiny.

"Any officer or soldier who, being present at any mutiny or sedition, does not use his utmost endeavours to suppress the same, or coming to the knowledge of any mutiny, or intended mutiny, does not, without delay, give information to his commanding-officer, is guilty of mutiny.

"Any officer or soldier, who shall strike his superior officer, or draw, or offer to draw, or shall lift up any weapon, or offer any violence against him, being in the execution of his office, on any pretence whatsoever, or shall disobey any lawful command of his superior officer, is guilty of mutiny.

MUZZLE *of a gun or mortar*, the extremity at which the powder and ball are put in; and hence the muzzle-ring, muzzle-astragal, muzzle-mouldings, &c. See CANNON.

N

NAILS of various sorts are used in artillery. See CARRIAGE.

Garnish NAILS, in *travelling-carriages*, have pointed heads like diamonds, with a small narrow neck: they serve to fasten the plates with roses, to cover the side-pieces from the ends of the trunnion-plates to 5 or 6 inches beyond the centre of the carriage.

Diamond-headed NAILS, small nails, whose heads are made like a flat diamond, and serve to fix the plates upon travelling-carriages.

Garnish NAILS, small nails to fasten the plates, both upon the trail and head of travelling-carriages.

Rose-bud NAILS, are small round-headed nails, drove in the centre of the roses of the plates.

Counter-sunk NAILS, those that have flat round heads, sunk into the iron plates, so as to be even with the outside of it.

Streak-NAILS, are those which fasten the streaks to the fellies of the wheels.

Box-pin NAILS, small nails without heads, to pin the nave-boxes to the naves.

Stub-NAILS, are driven on the outside of the nave-hoops, to keep them in their places.

Flat-headed NAILS, to fasten the locker or any sort of hinges.

Dog-NAILS, have flat round heads; and one part of the shank next to the head is also round.

NAILING *of cannon*. When circumstances make it necessary to abandon cannon, or when the enemy's artillery are seized, and it is not however possible to take them away; it is proper to nail them up, in order to render them

 useless;

uſeleſs; which is done by driving a large nail or iron ſpike into the vent of a piece of artillery, to render it unſerviceable. There are various contrivances to force the nail out, as alſo ſundry machines invented for that purpoſe, but have never been found of general uſe; ſo that the beſt method is to drill a new vent.

One Gaſper Vimercalus was the firſt who invented the nailing of cannon. He was a native of Bremen, and made uſe of his invention firſt in nailing up the artillery of Sigiſmund Malateſta.

NATIONAL *troops*, are thoſe born in our own dominions, in oppoſition to foreigners.

NAVAL *armament*, the fitting out a fleet, with all kinds of proviſions and military ſtores, for actual ſervice.

Naval *camp*, in *military antiquities*, a fortification, conſiſting of a ditch and parapet on the land ſide, or a wall built in the form of a ſemi-circle, and extended from one point of the ſea to the other. This was ſometimes defended with towers, and beautified with gates, through which they iſſued forth to attack their enemies. Towards the ſea, or within it, they fixed great pales of wood, like thoſe in their artificial harbours: before theſe the veſſels of burthen were placed in ſuch order, as that they might ſerve inſtead of a wall, and give protection to thoſe without; in which manner Nicias is reported by Thucydides to have encamped himſelf. When their fortifications were thought ſtrong enough to defend them from the aſſaults of enemies, it was frequent to drag their ſhips on ſhore, which the Greeks called ενελκειν, and the Romans *ſubducere*. Around the ſhips the ſoldiers diſpoſed their tents, as appears every where in Homer; but this ſeems only to have been practiſed in winter, when their enemy's fleet was laid up, and could not aſſault them; or in long ſieges, and when they lay in no danger from their enemies by ſea, as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a ſea-fight.

Naval *crown*, in *Roman antiquity*, a crown conferred, among the Romans, on perſons who, in ſea-engagements, diſtinguiſhed themſelves. A. Gellius ſays, in general, the naval crown was adorned with prows of ſhips. Lipſius diſtinguiſhes two kinds; the firſt he ſuppoſes plain, and given to the common ſoldiers; the other roſtrated, and only given to generals, or admirals, who had gained ſome important victory at ſea.

Naval *officers*, are admirals, captains, lieutenants, maſters, boatſwains, midſhipmen, gunners, &c.

Naval *engagement*, implies, in general, either a ſea-fight between ſingle ſhips, or whole fleets of men of war, or gallies, &c.

NAVE, in *gun-carriages*, that part of a wheel in which the arms of the axle-tree move, and in which the ſpokes are driven and ſupported. See Wheel.

Nave-*hoops*, are flat iron rings to bind the nave: there are generally three on each nave.

Nave-*boxes*, were formerly made of braſs; but experience has ſhown that thoſe of caſt-iron cauſe leſs friction, and are much cheaper: there are two, one at each end, to diminiſh the friction of the axle-tree againſt the nave.

NAVIGATION, the theory and art of conducting a ſhip by ſea, from one port to another, or of diſpoſing and actuating her machinery, by the force of the wind, ſo as to begin and continue her motion at ſea.

NAUMACHIA, in *antiquity*, a ſpectacle among the Romans, repreſenting a ſea-fight, as alſo the place where it was exhibited.

NAUTICAL *planiſphere*, a deſcription of the terreſtrial globe upon a plane, for the uſe of mariners; but more uſually called *chart*.

NAVY, implies, in general, any fleet or aſſembly of ſhips. It is, however, more particularly underſtood of the veſſels of war that belong to a kingdom or ſtate.

Navy-*board*, together with its civil and military departments, conſiſts of a lord high admiral, or lords commiſſioners for executing this office; one firſt lord commiſſioner, and ſix other lord commiſſioners, with a number of inferior officers, and clerks.

Navy, is alſo a collective body of officers employed in his majeſty's ſea-ſervice.

NECESSARIES, in a *military ſenſe*, implies, for each ſoldier, 3 ſhirts, 2 white ſtocks, 1 black hair-ſtock, one pair of braſs claſps for ditto, 3 pair of white yarn ſtockings, 2 pair of linen ſocks, dipped in oil, to be worn on a march; 2 pair of white linen gaiters, if belonging to the guards; 1 pair of black long gaiters, with black leather tops for ditto; 1 pair of half ſpatterdaſhes, 1 pair of linen drawers, 1 pair of red ſkirt breeches, 1 red cap, 1 cockade, 1 knapſack, 1 haverſack, 1 pair of ſhoe-buckles, 1 pair of gaiter-buckles, black leather garters, 2 pair of ſhoes, 1 oil-bottle, 1 bruſh and picker, 1 worm, 1 turn-key, 1 hammer-cap, and 1 ſtopper. See Regimentals.

NEUTRALITY, in *military hiſtory*, a ſtate of indifference, in which a perſon, army, or ſtate, avoids both friendſhip and hoſtility.

NITRE. See Saltpetre.

NON-*commiſſioned officer*. See Officer.

O

OBLIQUE *defence*, that which is under too great an angle, as is generally the defence of the fecond flank, which can never be fo good as a defence in front, nor approved of by fkilful officers. See *Oblique* FIRING, at the word FIRINGS.

OBUS. See HOWITZER.

OCTAGON, in *fortification*, is an eight-fided figure, or a place that has eight baftions. See FORTIFICATION.

OFFICERS, in a *military fenfe*, are of feveral denominations and ranks, viz.

Commiffioned OFFICERS, are thofe appointed by the king's commiffion; fuch are all from the general to the cornet and enfign.

Warrant OFFICERS, thofe who have no commiffions, only warrants from fuch boards, or perfons, who are authorifed by the king to grant them.

Non-commiffioned OFFICERS, are ferjeant-majors, quarter-mafter-ferjeants, ferjeants, corporals, drum and fife-majors, who are nominated by their refpective captains, and appointed by the commanding-officers of regiments, and by them reduced without a court-martial.

General OFFICERS, are thofe whofe command is not limited to a fingle company, troop, or regiment; but extends to a body of forces, compofed of feveral regiments: fuch are the general, lieutenant-general, major-general, and in fome armies brigadier-general.

Field OFFICERS, are fuch as command a whole regiment; as the colonel, lieutenant-colonel, and major.

Staff OFFICERS, are the quarter-mafter-general, and the adjutant-general, who are ftrictly faid only to exift in time of war; alfo the quarter-mafters, adjutants, furgeons, and chaplains of regiments. See STAFF.

Subaltern OFFICERS, are lieutenants, cornets, and enfigns.

Flag OFFICERS, are admirals who hoift flags at the maft-heads.

Sea OFFICERS, are, in general, all thofe who have any command in the navy.

OGEE, in pieces of ordnance, an ornamental moulding, in the fhape of an S, taken from architecture, and ufed in guns, mortars, and howitzers. See CANNON.

OLYMPIAD, in *chronology*, the fpace of four years, for on the fifth the olympic games were celebrated in honour of Jupiter Olympius, near Olympia. The Greeks began to ufe this epocha a little before the building of Rome.

OLYMPIC *games*, were inftituted by Hercules, A. M. 2856, in honour of Jupiter Olympius, at Olympia, a city of Elis, in Peloponnefus. They were celebrated every 4 years, about the fummer folftice. The defign of them was to accuftom the young military men to running, leaping, and every other military exercife.

OPEN *flank*, in *fortification*, that part of the flank, which is covered by the orillon. See FORTIFICATION.

OPENING *of trenches*, the firft breaking of ground by the befiegers, in order to carry on their approaches towards the place.

ORDERS, in a *military fenfe*, all that is lawfully commanded by fuperior officers. Orders are given out every day, whether in camp, garrifon, or on a march, by the commanding-officer; which orders are afterwards given to every officer in writing by their refpective ferjeants.

ORDER *of battle*. See BATTLE.

ORDERLY *ferjeant*, } are appointed to at-
ORDERLY *men*, } tend general officers, or fuch other officers who are entitled to fuch, who walk behind them with their arms.

ORDERLY *book*. Every company has fuch a book for the ferjeants to write down both general and regimental orders, for the officers to read them.

Military ORDERS, are companies of knights, inftituted by kings and princes; either for defence of the faith, or to confer marks of honour on their military fubjects. They are as follow:

Amaranth, an order of military knighthood, inftituted in Sweden, by queen Chriftina, in 1645, at the clofe of an annual feaft, celebrated in that country, and called *Wirtfchaft*. Their device was the cypher of *Amarante*, compofed of two *A*'s, the one erect, the other inverted, and interwoven together; the whole inclofed by a laurel crown, with this motto, *Dolce nella memoria*.

Argonauts of St. Nicolas, was the name of a military order, instituted by Charles III. king of Naples, in the year 1382, for the advancement of navigation, or, as some authors say, merely for preserving amity among the nobles. They wore a collar of shells, inclosed in a silver crescent, whence hung a ship with this device, *Non credo tempori.*

ORDER *of Calatrava*, a Spanish military order. It was instituted in 1130 by Don Santio, of Toledo. The habit of these knights is a black garment, with a red cross upon the breast.

ORDER *of Alcantara*, a Spanish military order. It was established by Ferdinand the second, king of Leon and Castile, in 1170. They wore a green cross upon their garment.

ORDER *of St. James*, instituted by Ferdinand II. in 1175. These knights had the privilege of wearing their hats in the chapter, in the presence of their sovereign.

ORDER *of St. Michael*, instituted in 1469, by Lewis XII. in honour of the important services done to France by that archangel at the siege of Orleans, where he is supposed to have appeared at the head of the French troops, disputing the passage of a bridge, and repulsed the attack of the English, whose affairs ever after declined in that kingdom. The order is a rich collar, with the image of that saint pendent thereto; with this inscription: *Immensi tremor oceani.*

ORDER *of the Holy Ghost*, instituted by Henry II. of France, in 1578. The number of knights are 100, besides the sovereign, who is always grand master.

Order of St. Louis, instituted by Louis XIV, in the year 1693. This order has remained entirely in the possession of military men, ever since its institution, and has been of singular use in keeping up the spirit, and rewarding the services, of those who have distinguished themselves. The number of knights is unlimited, being given to every man of merit. The order is a golden cross, with eight points, which hang pendent to a broad crimson ribband. The motto is *Bellicæ virtutis præmium.*

ORDER *of Mount Carmel*, instituted by Henry IV, in 1608.

ORDER *of St. Lazarus*, is of a very early institution, but has been often neglected, and as often revived, 'till Louis XV. united the order of St. Carmel and St. Lazarus in April 1722. The king is sovereign, chief, founder, and protector.

ORDER *of the knights of Malta.* See MALTA.

ORDER *of the knights of the Garter.* See GARTER.

ORDER *of the knights of the Bath.* See BATH.

ORDER *of the golden fleece*, instituted by Philip duke of Burgundy, surnamed the Good, in 1429. See FLEECE.

ORDER *of the annunciation*, instituted by Amadeo, count of Savoy, surnamed the Green, in memory of Amadeo, the first earl, who had valorously defended the island of Rhodes against the Turks. The collar belonging to this order is of gold, and on it these four letters, *F. E. R. T.* which means *Fortitudo ejus Rhodum tenuit*, with the figure of the Annunciation hanging to it.

ORDER *of knights templars*, instituted at Jerusalem about the year 1118. At first there were but 9 of the order, and the two principal persons were Hugo de Paganis, and Jeoffroy of St. Omer's. This order, after having performed many great exploits against the infidels, became rich and powerful all over Europe; when, on the 22d of May, 1312, the pope, by his bull, pronounced the extinction of the order, and united their estates to the order of St. John of Jerusalem. They took the name of templars, because their first habitation stood near the temple dedicated to our Saviour at Jerusalem.

ORDER *of knights of St. Jago*, instituted by king Ramico, of Spain, in commemoration of a victory obtained against the Moors, anno 1030. Their ensign is a red cross in form of a sword.

ORDER *of knights of the band*, erected by Alphonso, king of Spain, in the year 1268. Their name proceeded from the knights wearing a red scarf, or lace of silk, the breadth of 3 inches, which hung on their left shoulder.

ORDER *of knights of the Redemption*, erected in the kingdom of Arragon, by king James, who conquered the island of Majorca, in the year 1212. Their garments are white, with a black cross thereon.

ORDER *of Teutonic knights*, established towards the close of the 12th century, and thus called, as chiefly consisting of Germans, anciently called Teutons.

ORDER *of the knights of St. Stephen*, instituted in the year 1561, by Cosmo, duke of Florence. They wear a red cross with a border of gold.

ORDER *of merit*, instituted by Frederic III, king of Prussia, as a reward to those officers whose behaviour deserved some marks of distinction,

ſtinction. The enſign of this order is a golden ſtar of eight rays, enamelled with blue, which is worn appendant to a black ribbon, edged with ſilver; and the motto is *Pour le mérite.*

ORDER *of St. Alexander Newſki*, or the red ribbon, which was inſtituted by Peter I. emperor of Ruſſia; but the czarina Catharine I. conferred it in the year 1725.

ORDER *of the ſtole*, an order of knights inſtituted by the kings of Arragon.

ORDER *of the golden ſtole*, a Venetian military order, ſo called from a golden ſtole, which thoſe knights wore over their ſhoulder, reaching to the knee, both before and behind, a palm and a half broad. None are raiſed to this order but patricians, or noble Venetians. It is uncertain when this order was inſtituted.

ORDNANCE, a name given to all that concerns artillery: thus, the commander in chief is called maſter-general of the *ordnance*; the lieutenant-general of the *ordnance*, inſtead of *artillery*.

Board of ORDNANCE, is of a very early, but uncertain date; however, in the year 1548, we find Sir Philip Hoby ſtyled maſter of the ordnance; and in 1588, Ambroſe Dudley, earl of Warwick, was maſter of the ordnance. In 1683, the care of the office of ordnance was committed to five principal officers, beſides the maſter-general, then George lord Dartmouth, viz. a lieutenant-general, ſurveyor-general, clerk of the ordnance, ſtore-keeper, and a clerk of deliveries. At preſent the board of ordnance conſiſts of the ſame. This board deliberates, regulates, and orders every thing relating to the artillery and garriſons.

Maſter-general of the ORDNANCE, is an office of the greateſt truſt, honour, and dignity: it is one of the moſt laborious employments in war, and requires the greateſt ability, application, and experience. This officer has the ſole command of the royal regiment of artillery, aſſiſted by a lieutenant-general. By the great power inveſted in the maſter-general by the king, he alone conſtitutes a board. This poſt is of much greater antiquity in France than with us; for hiſtory informs us, that in the year 1358, John de Lion was appointed firſt maſter of artillery. This title continued 'till the year 1397, when John de Soiſi was appointed maſter-general of artillery. This title continued 'till the year 1599, when Maximilian de Bethune, marquis de Roſny, duke de Sully, and marſhal of France, was appointed firſt grand maſter and captain-general of artillery. This title continued 'till the year 1755, when the marquis de Sabrevois was appointed grand maſter of artillery, which title continues to this day.

In 1548, Sir Philip Hoby was ſtyled maſter of the ordnance.

In 1587, we find Ambroſe Dudley, earl of Warwick, ſtyled maſter of the ordnance, and had under him a maſter-gunner and a trench-maſter.

In 1596, the 29th of March, the earl of Eſſex was maſter of the ordnance.

In 1603, the earl of Devon was firſt called general of the ordnance.

In
- 1609, 27th June, the earl of Totneſs, ditto.
- 1617, 5th May, lord Vere.
- 1623, 26th Aug. Sir Richard Morriſon.
- 1628, Sir Thomas Stafford.
- 1634, 2d Sept. the earl of Newport.
- 1660, 22d Jan. Sir William Compton.
- 1664, 21ſt Oct. Sir Tho. Chicheley, knt. firſt called maſter-general of the ordnance.
- 1681, 28th Jan. lord Dartmouth.
- 1689, 28th April, David Schoumberg, eſq;
- 1693, 28th July, lord viſcount Sidney.
- 1702, 29th June, earl of Marlborough.
- 1711, 10th Jan. earl Rivers.
- 1712, 5th Sept. duke of Hamilton.
- 1714, 4th Oct. John duke of Marlborough.
- 1722, 30th June, William earl of Cadogan.
- 1725, 3d June, John duke of Argyll and Greenwich.
- 1730, 10th May, John duke of Montagu.
- 1755, 10th May, Charles duke of Marlborough.
- 1757, 30th Nov. John lord viſc. Ligonier.
- 1763, 30th Nov. marquis of Granby.
- 1772, 30th Nov. George lord viſcount Townſhend.

Honours due to the maſter-general of the ORDNANCE. The ſame reſpect ſhall be paid to him from the troops, as is paid to generals of horſe and foot; that is, on all occaſions, to have the march beat to him; and to be ſaluted by all officers, the colours excepted.

Lieutenant-general of the ORDNANCE, is an officer of great truſt, honour, and dignity; is the next in command under the maſter-general, and always an officer of the greateſt abilities. This office is not of ſuch early date as that of the maſter-general; for in 1597, it was firſt eſtabliſhed, and has continued as follows, viz.

In
- 1597, Sir George Carew, knight.
- 1635, Sir William Hayden.
- 1636, 28th June, Colin Legge, eſq;
- 1670, 21ſt Nov. David Walter, eſq;
- 1672, 7th Dec. George Legge, eſq;

In 1681, 28th Jan. Sir Charles Mufgrave.
1687, 1ft Aug. Sir Thomas Tichbourn.
1688, 26th April, Sir Hugh Goodrick.
1702, 29th June, James Granville, efq;
1705, 2d May, Thomas Earle, efq;
1712, 21ft June, James Hill, efq;
1714, 20th Sept. Thomas Earle, efq;
1717, 19th March, Tho. Micklethwaite, efq;
1718, 22d April, Sir Charles Willis.
1742, 22d April, field-marfhal Wade.
1748, 22d April, Sir John Ligonier.
1757, 30th Nov. lord George Sackville.
1759, 10th Sept. marquis of Granby.
1763, 10th Sept. George lord vifcount Townfhend.
1767, 10th Sept. right hon. Henry Seymour Conway.
1772, 10th Sept. Sir Jeffery Amherft, knight of the Bath; now lord Amherft.

Surveyor-general of the ORDNANCE, is the third perfon who conftitutes that board: it is a civil employment, of great truft, having the fuperintendence of the artillery proofs, military buildings, &c.

ORGUES, thick long pieces of wood, pointed and fhod with iron, clear one of another, hanging perpendicularly each by a rope, over the gate of a ftrong place, to be dropped in cafe of emergency.

Their difpofition is fuch, that they ftop the paffage of the gate, and are preferable to *herfes* or *portcullifes*; becaufe thefe may be either broken by a petard, or ftopped, by different contrivances, in their falling down. But a petard is ufelefs againft an *orgue*; for if it break one or two of the pieces, others immediately fall down and fill up the vacancy.

ORGUES, a number of harquebuffes linked together, or diverfe mufket-barrels laid in a row, fo that they may be difcharged all at once, or feparately.

ORTHOGRAPHY. See PROFILE.

ORILLON. See FORTIFICATION.

ORTEIL. See BERM, and FORTIFICATION.

OVERSLAGH, as a *military phrafe*, which is derived from the Dutch, will be better explained by the following table. For inftance, fuppofe 4 battalions, each confifting of 8 captains, are doing duty together, and that a captain's guard is daily mounted: if, in the buffs, the fecond captain is doing duty of deputy-adjutant-general; and the 4th and 7th captains in the king's are acting, one as aid-de-camp, the other as brigade-major; the common duty of thefe three captains muft be *overflaghed*, that is, flipped over, or equally divided among the other captains.

TABLE *of explanation.*

		Heads of each column.							
Regiments	N°. of captains	1	2	3	4	5	6	7	8
Royal	8	1		5	2	15	19	23	26
Queen's royal	8		6	9	13	16	20	24	27
Old-buffs	8	3		10	14	17	21	25	28
King's own	8	4	7	11		18	22		19
Total	32								

OUT-*pofts*, in a *military fenfe*, a body of men pofted beyond the grand guard, called out-pofts, as being without the rounds or limits of the camp. See POSTS.

OUT-*works*, in *fortification*, are works of feveral kinds, which cover the body of the place, as ravelins, half-moons, tenailles, horn-works, crown-works, counterguards, envelopes, fwallows-tails, lunettes, covert-ways, glacis, &c.

Thefe out-works, not only cover the place, but likewife keep an enemy at a diftance, and hinder his gaining any advantage of hollow or rifing grounds; as fuch cavities and eminences may ferve for lodgements to the befiegers, facilitate the carrying on approaches, and raifing their batteries againft the town. When out-works are placed one before another, you will find a ravelin before the curtain, a horn-work before the ravelin, and a fmall ravelin before the curtain of the horn-work; then the neareft to the body of the place muft be the higheft, though lower than the body of the place, that they may gradually command thofe without them, and oblige the enemy to diflodge, if in poffeffion of them.

P

PACE, in a *military sense*, a measure used in fortification: it is a measure taken from the space between the two feet of a man in walking, usually reckoned 2½ feet, and in some men 3 feet.

Geometrical PACE, is 5 feet; 60,000 of which make one degree of the equator.

PAGEANT, in *ancient military history*, a triumphal car, chariot, arch, or other like pompous decoration, variously adorned with colours, flags, &c. carried about in public shows, processions, &c.

PALÆSTRA, in *Grecian antiquity*, a public building, where the youth exercised themselves in the military art, wrestling, running, playing at quoits, &c.

PAILS, made of wood, with iron hoops and handles, hold generally 4 gallons, and serve in the field to fetch water for the use of artillery works, &c.

PAILLASSE, in *military history*, is a French word, adopted and used in our language by the military: it implies a canvass or sail-cloth bed-case, stuffed with straw; litterally, a straw-bed.

PALISADES, in *fortification*, stakes made of strong split wood, about 9 feet long, 6 or 7 inches square, 3 feet deep in the ground, in rows about 2½ or 3 inches asunder, placed in the covert-way, at 3 feet from and parallel to the parapet or side of the glacis, to secure it from surprise.

They are also used to fortify the avenues of open forts, gorges, half-moons, the bottoms of ditches, and, in general, all posts liable to surprise. They are usually fixed perpendicularly, though some make an angle inclining towards the ground next the enemy, that the ropes cast over them, to tear them up, may slip off.

Turning PALISADES, are an invention of Mr. Coehorn, in order to preserve the palisades of the parapet of the covert-way from the besiegers shot. They are so ordered, that as many of them as stand in the length of a rod, or about 10 feet, turn up and down like traps, so as not to be in sight of the enemy, 'till they just bring on their attack; and yet are always ready to do the proper service of palisades.

PANDOURS, are Hungarian infantry: they wear a loose garment fixed tight to their bodies by a girdle, with great sleeves, and large breeches reaching down to their ancles. They use fire-arms, and are excellent marksmen: they also wear a kind of sabre, near 4 feet long, which they use with great dexterity.

PANNELS, in *artillery*, are the carriages which carry mortars and their beds upon a march.

PARABOLA, in *geometry*, a figure arising from the section of the cone, when cut by a plane parallel to one of its sides.

From the same points of a cone, therefore, only one parabola can be drawn; all the other sections within these parallels being ellipses, and all without hyperbolas.

Properties of the PARABOLA. The square of an ordinate is equal to the rectangle of the abscissa, and four times the distance of the focus from the vertex.

The perpendicular on the tangent, from the focus, is a mean proportional between the distance from the vertex to the focus, and the distance of the focus from the point of contact.

All lines within the parabola, which are drawn parallel to the axis, are called diameters.

The parameter of any diameter is a right line, of such a nature that the product under the same, and the abscissa, is equal to the square of the semi-ordinate.

The squares of all ordinates to the same diameter, are to one another as their abscissas.

Cartesian PARABOLA, is a curve of the second order, expressed by the equation $xy = ax^3 + bx^2 + cx + d$, containing 4 infinite legs, being the 66th species of lines of the third order, according to Sir Isaac Newton; and is made use of by Descartes, in the third book of his geometry, for finding the roots of equations of six dimensions by its intersections with a circle.

Diverging PARABOLA, a name given by Sir Isaac Newton to 5 different lines of the third order, expressed by the equation $yy = ax^3 + bx^2 + cx + d$.

PARADE, in a *military sense*, the place where troops assemble, or draw together, to mount guard, or for any other purpose.

PARADE, in *fencing*, implies the action of parrying, or turning off any thrust.

PARALLELS, at a siege, the trenches or lines made parallel to the defence of the place besieged: they are also called lines of communication, and boyaus.

PARALLELS, or places of arms, are deep trenches 15 or 18 feet wide, joining the several attacks together, serve to place the guard of the trenches in readiness to support the workmen when attacked. There are usually 3 in an attack; the 1st, about 300 toises from the covert-way; the 2d and 3d, nearer to the glacis.

PARAMETER. See GUNNERY, and PROJECTILES.

PARAPET, in *fortification*, an elevation of earth, designed for covering the soldiers from the enemy's cannon, or small shot: its thickness is from 18 to 20 feet; its height 6 on the inside, and 4 or 5 on that side next the country: it is raised on the rampart, and has a slope called the superior talus, or glacis of the parapets, on which the troops lay their arms to fire over. The slope renders it easy for the soldiers to fire into the ditch. It has a banquette or two on the inside for the troops who defend it, to mount upon, for better discovering the country, the ditch, and counterscarp, to fire as they find occasion.

PARAPET *of the covert-way*, is what covers that way from the sight of the enemy; which renders it the most dangerous place for the besiegers, because of the neighbourhood of the faces, flanks, and curtains of the place.

PARK *of artillery*. See ARTILLERY-PARK.

PARK *of provisions*, the place where the sutlers pitch their tents in the rear, and sell provisions to the soldiers. Likewise that place where the bread-waggons are drawn up, and where the troops receive their ammunition-bread, being the store of the army.

PARLEY, in *military matters*, means a conference with an enemy.

To beat a PARLEY, is to give a signal for holding such a conference, by beat of drum, or sound of trumpet. See CHAMADE.

PAROLE, in a *military sense*, the promise made by a prisoner of war, when he has leave to go any where, of returning at a time appointed, if not exchanged.

PAROLE, means also a word given out every day in orders by the commanding officer, both in camp and garrison, in order to know friends from enemies.

PARTISAN, in the *art of war*, a person dexterous in commanding a party; who, knowing the country well, is employed in getting intelligence, or surprising the enemy's convoy, &c. The word also means an officer sent out upon a party, with the command of a body of light troops, generally under the appellation of the partisan's corps. It is also necessary that this corps should be composed of infantry, light-horse, and hussars.

PARTY, in a *military sense*, a small number of men, horse, or foot, sent upon any kind of duty; as into an enemy's country, to pillage, to take prisoners, and oblige the country to come under contribution. Parties are often sent out to view the roads and ways, get intelligence, seek forage, reconnoitre, or amuse the enemy upon a march; also frequently sent upon the flanks of an army, or regiment, to discover the enemy, if near, and prevent surprise or ambuscade.

PARRYING, in *fencing*, the action of warding off the push or blow aimed at one by another. See FENCING.

PASS, in a *military sense*, a strait, difficult, and narrow passage, which shuts up the entrance into a country.

PASS, PASSADE, } in *fencing*, an advance or leap forward upon the enemy.

PASSADE, in the *manage*, is a horse's walking or trotting in such a manner, that he raises the outward hind-leg and the inward fore-leg together; and, setting these two on the ground, raises the other two alternately, never gaining above a foot of ground at a time.

PASS-*parole*, in *military affairs*, a command given at the head of an army, and thence communicated to the rear, by passing it from mouth to mouth.

PASS-*port*, or PASS, in *military matters*, a licence or writing obtained from a prince or governor, &c. granting liberty and safe conduct to pass through his territories without molestation.

PASS-*volant*, PASSE-*volant*, } in a *military sense*, the same with faggot. See FAGGOT.

PATEE, in *fortification*, a small work resembling a horse-shoe; that is, an elevation of earth, of an irregular form, generally oval, with a parapet. It is frequently raised in marshy grounds, to cover the gate of a place, having only a direct defence, but nothing to flank it.

PATROL, in *war*, rounds made by the different guards, in the night-time, to observe what passes in the camp, out-posts, streets, centries, &c. to secure the peace and tranquillity of a city or camp; as also to keep all on duty alert. The patrol generally consists of 6 or 12 men and a serjeant.

They go every hour in the night from the beating of the tattoo until the reveille: they are to walk in the streets in garrisons, and all over the camp in the field, to prevent disorders, or any number of people from assembling together: they are to see the lights in the soldiers barracks put out, and to take up all the soldiers they find out of their quarters.

Sometimes *patrols* consist of an officer and 30 or 40 men, as well infantry as cavalry; but then the enemy is generally near at hand, and consequently the danger greater.

PAVILION, in *military affairs*. See TENT.

PAY, or *pay of the army*, is the stipend or salary allowed for each individual serving in the army; first established by government in the year 1660, and not altered since.

Daily

Daily pay of each rank in the horse and grenadier-guards.	Horse-guards		Grenadier-guards	
	Full-pay	Subsist.	Full-pay	Subsist.
Captain and colonel	1 16 0	1 7 0	1 10 0	1 2 6
Lieutenant and lieutenant-colonel 1st	1 11 0	1 3 3	—	—
Lieutenant and lieutenant-colonel 2d	1 7 0	1 0 6	1 2 6	0 17 0
Cornet and major, H. G. major in G. G	1 6 0	0 19 6	1 0 0	0 15 0
Guidon and major	1 4 0	0 18 0	—	—
Exempt and Capt. H. G. Lieut. and Capt. G. G.	0 16 0	0 12 1	0 17 0	0 13 0
Brigadier and lieut. H. G. sub-lieut. G. G.	0 11 0	0 8 2	0 10 0	0 7 6
Guidon and captain	—	—	0 16 0	0 12 0
Sub-brigadier and cornet	0 6 0	0 4 0	—	— 0
Chaplain	0 6 8	0 5 0	0 6 8	0 5
Adjut. and lieut. H. G. sub-lieut. and adj. G. G.	0 11 0	0 8 0	0 7 0	0 5 6
Surgeon	0 8 0	0 6 0	0 8 0	0 6 0
Quarter-master H. G. serjeant G. G.	0 6 0	0 4 9	0 4 0	0 3 6
Corporal	0 5 0	0 3 9	0 3 0	0 2 6
Trumpeter and kettle-drum H. G. haut-boys or drum G. G.	0 5 0	0 4 0	0 2 6	0 2 0
Private man	0 4 0	0 2 10	0 2 6	0 2 0

Besides the pay, as above, there are warrant-men allowed on the establishment, viz. to a colonel 6, to a lieutenant colonel 3, to a major 2, to a captain, sub-lieutenant, adjutant, and clerk, 1 each; to agent H. G. 2, to G. G. 3; riding-master H. G. 1, to G. G. 2: allowance to the purveyor and rough-rider 1s. each.

N. B. The fractions, as being inconsiderable, are omitted.

Daily pay of each rank in his majesty's land-forces. British.	Royal reg. of horse-guards		Dragoons		Foot-guards		Foot	
	F. pay	Subsist.	F. pay	Subsist.	F. pay	Subsist.	F. pay	Subsist.
Colonel	2 1 0	1 11 0	1 15 0	1 6 6	1 19 0	1 10 0	1 4 0	0 18 0
Lieutenant-colonel	1 9 6	1 2 6	1 4 6	0 18 6	1 8 6	1 1 6	0 17 0	0 13 0
Major	1 7 0	1 1 6	1 0 6	0 15 6	1 4 6	0 18 6	0 15 0	0 11 6
Captain	1 1 6	0 16 0	0 15 6	0 11 6	0 16 6	0 12 6	0 10 0	0 7 6
Capt. lieut. or lieut.	0 15 0	0 11 6	0 9 0	0 7 0	0 7 10	0 6 0	0 4 8	0 3 6
Cornet H. G. and drag. Ens. F. G. E. or 2 L. F.	0 14 0	0 11 0	0 8 0	0 6 0	0 5 10	0 4 6	0 3 8	0 3 0
Chaplain	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0
Adjutant, or solicitor	0 5 0	0 4 6	0 5 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Quarter-master	0 8 6	0 6 6	0 5 6	0 4 0	0 4 0	0 3 0	0 4 8	0 3 6
Surgeon	0 6 0	0 4 6	0 6 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Surgeon's mate	—	—	—	—	0 3 0	0 3 0	0 3 6	0 3 0
Drum-major	—	—	—	—	0 1 0	0 1 0	—	—
Deputy-marshal	—	—	—	—	0 1 0	0 0 9	—	—
Serjeant	—	—	0 2 9	0 2 3	0 1 10	0 1 4	0 1 6	0 1 0
Corporal	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 10	0 1 0	0 0 8
Kettle-drum	0 3 0	0 2 6	—	—	—	—	—	—
Drummer	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 8	0 1 0	0 0 8
Trumpeter	0 2 8	0 2 0	—	—	—	—	—	—
Private man	0 2 6	0 2 0	0 1 9	0 1 5	0 0 10	0 0 $6\frac{6}{7}$	0 0 8	0 0 6

Besides the pay the following allowances are made: To the colonel of the royal regiment of horse-guards 4s. per day; dragoons 2s. 6d. foot-guards 1s. $7\frac{1}{4}$d. foot 1s. 2d. To the captains of the horse-guards 4s. dragoons 4s. foot-guards 1s. $1\frac{1}{2}$d. foot 1s. per day.

Daily pay of the roy. reg. of artillery	Full pay						Arrears					
	Pay			Subsist.			per day			per ann.		
Serjeants	0	2	0	0	1	7¾	0	0	4½	6	9	3¾
Corporals	0	1	10	0	1	6½	0	0	3½	5	6	5½
Bombardiers	0	1	8	0	1	4½	0	0	3½	5	6	5½
Gunners	0	1	4	0	1	1¼	0	0	2¾	4	3	7¼
Matrosses	0	1	0	0	0	9½	0	0	2½	3	16	0½
Fifers	0	1	0	0	0	9½	0	0	2½	3	16	0½
Drummers	0	1	0	0	0	9½	0	0	2½	3	16	0½

N. B. The officers are the same as the foot in the preceding table.

PAY-*master*, is he who is intrusted with the money, and has the charge of paying the company.

PEACE, a state of tranquillity, and generally used in opposition to war. See WAR.

PEDRERO. See MORTAR.

PENDULUM, in *mechanics*, any heavy body so suspended, as that it may vibrate backwards and forwards, about some fixed point, by the force of gravity.

A pendulum is any body, as *B* (Pl. X. *fig.* 6.) suspended upon, and moving about, a point *A* as a centre. The nature of a pendulum consists in the following particulars. 1. The times of the vibrations of a pendulum, in very small arches, are all equal. 2. The velocity of the bob, in the lowest point, will be nearly as the length of the cord of the arch which it describes in the descent. 3. The times of vibrations in different pendulums, *AB*, *AC*, are the square roots of the times of their vibrations. 4. The time of one vibration is to the time of descent, through half the length of the pendulum, as the circumference of a circle is to its diameter. 5. Whence the length of a pendulum, vibrating seconds in this latitude, will be found to be 39 inches and 2-10ths; and of one half-second pendulum 9.8 inches. 6. An uniform homogeneous body *B G* (Pl. X. *fig.* 7.) as a rod, staff, &c. which is 1-3d part longer than a pendulum *AD*, will vibrate in the same time with it.

From these properties of the pendulum, we may discern its use as an universal chronometer, or regulator of time. By this instrument, also, we can measure the distance of a ship, of a battery, &c. by measuring the interval of time between the fire and report of the gun; also the distance of a cloud, by counting the seconds or half-seconds, between the lightning and the thunder. Thus, suppose between the lightning and thunder we count 10 seconds; then, because sound passes through 1142 feet in one second, we get the distance of the cloud = 11420 feet. Again, the height of any room, or other object, may be measured by a pendulum vibrating from the top thereof. Thus, suppose a pendulum from the height of a room, or other object, vibrates once in three seconds; then say, as 1 is to the square of 3, viz. 9, so is 39.2 to 352.8 feet, the height required. Lastly, by the pendulum we discover the different force of gravity on divers parts of the earth's surface, and thence the true figure of the earth.

PENSIONS *for officers widows*. Colonel's widow 50l. lieut. colonel's 40l. major's 30l. captain's 26l. lieutenant's 20l. ensign's 16l. cornet's 16l. adjutant's 16l. quarter-master's 16l. surgeon's 16l. and chaplain's 16l.

PENSIONERS, or *band of gentlemen pensioners*, raised in 1509 by king Henry VIII. to guard his person. They consist of a captain, lieutenant, standard-bearer, clerk of the cheque, and 40 gentlemen pensioners, with a salary of 100l. a year each. They have also a paymaster, harbinger, ax-keeper, and messenger.

PENTAGON, in *fortification*, a figure bounded by 5 sides, or polygons, which form so many angles, capable of being fortified with an equal number of bastions. It also denotes a fort with 5 bastions.

PERCH, in mensuration, is 10 feet long. See MEASURE.

PERCUSSION, in *physics*, the impression a body makes in falling or striking another; or the shock of two moving bodies: and it is either direct or oblique.

Direct PERCUSSION, is where the impulse is given in the direction of a right line perpendicular to the point of contact.

Oblique PERCUSSION, when it is given in the direction of a line oblique to the point of contact.

Centre of PERCUSSION, of a body in motion, is that point in which all the forces of the same are considered as united together in one; so that, if the said body meets any obstacle contrary to the motion thereof, it strikes the obstacle with a greater force than any other point of the body; and consequently, if the percutient body revolves round a fixed point, and in its motion strikes any obstacle with its centre of percussion, it will, during a small particle of time, preserve an equilibrium about that point.

Let the inflexible right line *PB* (Pl. XIII. *fig.* 4.) with two given weights *A*, *B*, appended at the point *A* and *B*, revolve about the fixed point *P*, as a centre; and let it be required to determine the centre of percussion *C*, of the said weights.

Put $BC = x$; then $CA = BA - x$. The velocity with which *B* revolves, is as *PB*; therefore its force may be expressed $PB \times B$; and by the same way of reasoning, the force of *A* may be expounded by $PA \times A$: therefore, by

by the above definition of the centre of percussion, we have $PB \times B \times x = \overline{BA} - x \times PA \times A$; hence $x = \dfrac{PB \times PA \times A}{PB \times B + PA \times A}$; subtract this from PB, and we have PC, or the distance of the centre of percussion from the point of suspension P, $= \dfrac{PA^2 \times A + PB^2 \times B}{PA \times A + PB \times B}$

If there were three, or a greater number of weights affixed to the rod PB, the distance of their centre of percussion from the point of suspension would, in like manner, be found by first multiplying each weight into the square of its distance from the point of suspension, and dividing the sum of these products by that of the products arising from the multiplication of each weight into its respective distance, from the point of suspension. Hence it appears that the centre of percussion is the same with the centre of oscillation.

PERPENDICULAR, in *geometry*, a line falling directly upon another line, so as to make equal angles on each side.

PERDUE, in *war*, denotes the forlorn hope; and *to lie perdue*, is to lie flat and closely in wait.

PERSPECTIVE, is the art of drawing the resemblances or pictures of objects on a plane surface, as the objects themselves appear to the eye, &c.

PETARD, in *war*, an engine to burst open the gates of small fortresses: it is made of gun-metal, fixed upon a board two inches thick, and about 2½ feet square, to which it is screwed, and holds from 9 to 20 pounds of powder, with a hole at the end opposite to the plank to fill it, into which the vent is screwed: the petard thus prepared is hung against the gate by means of a hook, or supported by three staves fastened to the plank: when fired, it bursts open the gate. Its invention is ascribed to the French Huguenots in 1579, who, with them, took Cahors in 1579.

PETARDIER, he who loads, fixes, and fires the petard.

PETITE-GUERRE, is carried on by a light party, commanded by an expert partisan, and which should be from 1000 to 2000 men, separated from the army, to secure the camp or a march; to reconnoitre the enemy or the country; to seize their posts, convoys, and escortes; to plant ambuscades, and to put in practice every stratagem for surprising or disturbing the enemy; which is called carrying on the *Petite-guerre*. The genius of these days, and the operations of the last war, have placed the service of such a corps in a most respectable light, as it is more fatiguing, more dangerous, and more extensive.

To form a corps capable of carrying on the *Petite-guerre* to advantage, prudence requires that it should consist of 1000 men at least, without which a partisan cannot expect to support the fatigues of a campaign, and seize the most important occasions that every where offer, and which a too great inferiority must make him forego.

It is no less important that this corps should be composed of infantry and cavalry; and as it is incontestible that the cavalry should be the most active in carrying on the *Petite guerre*, it were to be wished that they were likewise the strongest, so as to have 600 cavalry and 400 infantry in a corps of 1000 men, making 4 companies of infantry, and 12 troops of cavalry. Each company of infantry to consist of 1 captain, 1 first and 2 second lieutenants, 4 serjeants, and 96 men, including 4 corporals, 4 lance corporals, and 2 drummers. Each troop of cavalry to consist of 1 captain, 1 first and 1 second lieutenant, a quarter-master, 2 serjeants, and 48 horsemen; including 4 corporals, a trumpeter and farrier.

The commanding-officer should have the naming of the officers of this corps, or at least the liberty to reject such as he is convinced are not qualified for such service. To support the honour of this corps upon a solid and respectable footing, the strictest subordination must extend from the chief to all the officers, and the most rigid discipline inspire vigilance, patience, bravery, and love of glory in the whole corps.

PHALANX, in *ancient military history*, a large square battalion of infantry, joined close together, with their shields in close order, and pikes turned cross-ways. The phalanx was a form peculiar to the Macedonians: the front exceeded the depth, and the depth consisted generally of 16 men.

PICKETS, in *fortification*, stakes sharp at one end, and sometimes shod with iron, used in laying out the ground, of about 3 feet long; but, when used for pinning the fascines of a battery, they are from 3 to 5 feet long.

PICKETS, in *artillery*, are about 5 or 6 feet long, shod with iron, to pin the park lines, in laying out the boundaries of the park.

PICKETS, in the *camp*, are also stakes of about 6 or 8 inches long, to fasten the tent cords, in pitching the tents; also, of about 4 or 5 feet long, driven into the ground near the tents of the horsemen, to tie their horses to.

PICKET, an out-guard posted before an army, to give notice of an enemy approaching. See GUARD.

PICKET, a kind of punishment so called, where

where a soldier stands with one foot upon a sharp-pointed stake: the time of his standing is limited according to the offence.

PIECES, signify cannon of all denominations. See CANNON.

Regimental PIECES, are light 3 and 6-pounders: each regiment has generally two of these pieces.

Field-PIECES, are light 3, 6, and 12-pounders. See CANNON.

Battering-PIECES, are heavy, 12, 18, and 24-pounders, used in sieges for battering the works of a fortification. See CANNON.

Garrison-PIECES, are mostly heavy 6, 9, 12, 18, 24, 36, and 42-pounders, besides wall-guns.

PIKE, in *war*, an offensive weapon, consisting of a wooden shaft, 12 or 14 feet long, with a flat steel head, pointed, called the spear. This weapon was long in use among the infantry; but now the bayonet, which is fixed on the muzzle of the firelock, is substituted in its stead. It is still used by some of the officers of infantry, under the name of sponton. The Macedonian phalanx was a battalion of pike-men.

PILES *of shot or shells*, are generally piled up in the king's magazines, in three different manners: the base is either a triangular square, or a rectangle; and from thence the piles are called triangular, square, and oblong.

TABLE *of triangular* PILES *of shot.*

Side	Content	Side	Content	Side	Content	Side	Content
2	4	13	473	24	2437	35	7486
3	10	14	574	25	2751	36	8184
4	20	15	696	26	3091	37	9322
5	35	16	731	27	3458	38	10131
6	56	17	883	28	3853	39	10981
7	84	18	1043	29	4277	40	11871
8	120	19	1222	30	4731	41	12807
9	165	20	1540	31	5216	42	13730
10	220	21	1641	32	5733	43	14659
11	296	22	1883	33	6283	44	15585
12	384	23	2148	34	6867	45	16511

Explanation.---The numbers in the 1st, 3d, 5th, and 7th vertical columns, express the number of shot in the base or side of each triangular pile; and the numbers in the 2d, 4th, 6th, and 8th vertical columns, express the number of shot in each pile.

If the triangular prism $ABCD$ of shot (Pl. XIII. *fig.* 3.) whose side BD or AC, is equal to the corner row AB, be cut diagonally by a plane CF, it is evident that the triangular pyramid CFD, is 1-3d of the prism; and the remainder CFA, the 2-3ds.

Now because the number of shot in the triangular base ABC, is expressed by the terms 1, 2, 3, 4, 5, &c. of the natural numbers, whose last term $= z$, the number of shot in the base AC; and the sum of all the terms, to the sum $1+2$ of the first and last multiplied by $\frac{1}{2}z$ half their number; that is, to $\frac{1}{2}z \times \overline{z+1}$.

The base ABC, multiplied by z, the number of triangles contained in the prism $ABDC$, gives $\frac{1}{2}zz \times \overline{z+1}$ for its content, and $\frac{2}{3}$, $\frac{1}{2}zz \times \overline{z+1}$ of which, that of the part AFC. But it is evident, that the plane CF cuts the triangular range CB into two parts; the one, CFB, is for the same reason as above, $\frac{1}{3}$ of $\frac{1}{2}z \times \overline{z+1}$ that range, which third $\frac{1}{6}z \times \overline{z+1}$, will express the part CFB. This being added to $\frac{1}{3}zz \times \overline{z+1}$, found before gives $\frac{1}{3}zz \times \overline{z+1} + \frac{1}{6}z \times \overline{z+1}$, or $\frac{1}{6}z \times \overline{z+1} \times \overline{zz+1}$, when reduced under the same denomination, for the square pile ABC, or fig. 2. $ABCD$.

Rule I. Multiply the base by the base more 1, this product by the base more 2, and divide by 6.

Example I. Let the base or corner row of a complete triangular pile be 20; then $\frac{20 \times 21 \times 22}{6} = 10 \times 7 \times 22 = 1540$, for the number of shot required.

TABLE *of square* PILES *of shot.*

side	content	side	content	side	content	side	content	side	content
2	5	20	2871	38	19019	56	60116	74	137825
3	14	21	3311	39	20540	57	63365	75	143450
4	30	22	3795	40	22140	58	66729	76	149226
5	55	23	4324	41	23821	59	70210	77	155155
6	91	24	4900	42	25585	60	73810	78	161239
7	140	25	5525	43	27434	61	77531	79	167480
8	204	26	6201	44	29370	62	81375	80	173880
9	285	27	6930	45	31395	63	85344	81	180441
10	385	28	7714	46	33511	64	89440	82	187165
11	506	29	8555	47	35720	65	93665	83	194054
12	650	30	9455	48	30824	66	98021	84	201110
13	819	31	10416	49	40425	67	102510	85	208335
14	1015	32	11140	50	42925	68	107134	86	215731
15	1240	33	12529	51	45526	69	111895	87	223300
16	1496	34	13685	52	48230	70	116795	88	231044
17	1785	35	14910	53	51939	71	121830	89	238965
18	2109	36	16206	54	53953	72	127022	90	247065
19	2470	37	17575	55	56980	73	132349	91	255346

Explanation.

[To be placed opposite *Table of oblong* PILES *of shot*, at the word PILES.]

	1	2	28	29	30	31	32	33	34	35	36	37	38
10	385	4	1878	1925	1980	2035	2090	2145	2200	2255	2310	2365	2420
11	506	5	2288	2354	2420	2486	2552	2618	2684	2750	2816	2882	2948
12	650	7	2756	2834	2912	2990	3068	3146	3224	3302	3380	3458	3536
13	819	9	3276	3367	3458	3549	3640	3731	3822	3913	4004	4095	4186
14	1015	11	3850	3955	4060	4165	4270	4375	4480	4585	4690	4795	4900
15	1240	13	4480	4600	4720	4840	4960	5080	5200	5320	5440	5560	5680
16	1496	16	5168	5304	5440	5576	5712	5848	5984	6120	6256	6392	6528
17	1785	19	5916	6069	6222	6375	6528	6681	6834	6987	7140	7293	7446
18	2109	22	6726	6897	7068	7239	7410	7581	7752	7923	8094	8265	8436
19	2470	26	7600	7790	7980	8170	8360	8550	8740	8930	9020	9310	9500
20	2870	30	8540	8750	8960	9170	9380	9590	9800	10010	10220	10430	10640
21	3311	35	9548	9779	10010	10241	10472	10703	10934	11165	11396	11627	11858
22	3795	40	0626	10879	11132	11385	11638	11891	12144	12397	12650	12903	13156
23	4324	46	1776	12052	12328	12604	12880	13156	13432	13708	13984	14260	14536
24	4900	52	3000	13300	13600	13900	14200	14500	14800	15100	15400	15700	16000
25	5525	58	4300	14625	14950	15275	15600	15925	16250	16575	16900	17225	17550
26	6201	65	5678	16029	16380	16731	17082	17433	17784	18135	18486	18837	19188
27	6930	73	7136	17514	17892	18270	18648	19026	19404	19782	20160	20538	20916
28	7714	81	8676	19082	19488	19894	20300	20706	21112	21518	21924	22330	22736
29	8555	89	0300	20735	21170	21605	22040	22475	22910	23345	23780	24215	24650
30	9455	99	2010	22475	22940	23405	23870	24335	24800	25265	25730	26195	26660
31	10416	109	3808	24304	24800	25296	25792	26288	26784	27280	27776	28272	28768
32	11440	119	5696	26224	26752	27280	27808	28336	28864	29392	29920	30448	30976
33	12529	130	27676	28237	28798	29359	29920	30481	31042	31603	32164	32725	33286
34	13685	142	29750	30345	30940	31535	32130	32725	33320	33915	34510	35105	35700
35	14910	155	31920	32550	33180	33810	34440	35070	35700	36330	36960	37590	38220
36	16206	168	34188	34854	35520	36186	36852	37518	38184	38850	39516	40182	40848

EXPLANAT e head column from 1 to 38, the bottom row at the end.—*Example.* To know ho 12, and opposite 15, will be 2560; the shot contained in such an oblong finished p

Explanation. The numbers gradually increasing, from 2 to 91, expreſs the number of ſhot at the baſe of each ſquare pile; and the numbers oppoſite, the quantity of ſhot in each complete ſquare pile. *Example.* N°. 20 gives 2871, and N°. 30 gives 9455; and ſo of the reſt.

Rule II. Multiply the corner row, by the corner row more 1; this product by twice the corner row more 1, and divide by 6.

Example II. Let the ſide AC (Pl. XIII. *fig.* 2.) of a complete ſquare pile be 36; then $\frac{36 \times 37 \times 73}{6} = 6 \times 37 \times 73 = 16206$, for the required number of ſhot in that pile.

Example III. Let the ſide of a ſquare unfiniſhed pile be 25, and the corner 18; then $\frac{25 \times 26 \times 51}{6} = 25 \times 13 \times 17 = 5525$, by the firſt rule, for the content of the complete pile: now 18 taken from 25, leaves 7, and $\frac{7 \times 8 \times 15}{6} = 7 \times 4 \times 5 = 140$ for the part wanting, which taken from 5525 leaves 5385 for the number required.

Table of oblong Piles *of ſhot.*

Rule III. From three times the length of the baſe more 1, ſubtract the breadth, multiply the remainder by the product of the breadth more 1, and divide by 6.

Example IV. Let the length AE of a complete oblong pile be 50, and the breadth 20; then 3 times 50 more 1, and 20 ſubtracted gives 131, and $\frac{131 \times 20 \times \times 21}{6} = 131 \times 10 \times 7 = 9170$, for the number required.

To find the conduct of the oblong Pile *ABDLE, fig.* 4.

Example V. Let the baſe $AE = a$, and the breadth $= z$; then will $CE = a - z$. This length, multiplied by $\frac{1}{2} z \times \overline{z + 1}$, the triangular baſe EDL, gives $\overline{a - z} \times \frac{1}{2} z \times \overline{z + 1}$, for the priſm $CBDLE$; to which add $\frac{1}{6} z \times \overline{z + 1} \times \overline{zz + 1}$, the content of the ſquare pyramid ABC, we get $\overline{a - z} \times \frac{1}{2} z \times \overline{z + 1} + \frac{1}{6} z \times \overline{z + 1} \times \overline{zz + 1}$, or $\overline{3a - z + 1} \times \frac{1}{6} z \times \overline{z + 1}$, when reduced under the ſame denomination, for the content required.

Example VI. Let the length of an oblong unfiniſhed pile be 25, its breadth 9, and corner row 6; then, by the 5th example, 3 times 25 more 1 and leſs 9, gives 67 and $\frac{67 \times 9 \times 10}{6} = 67 \times 3 \times 5 = 1005$, for the complete pile: now the corner row 6 taken from the ſide 25, and breadth 9, leaves 19 and 3; then 3 times 19 more 1, leſs 3, gives 55, and $\frac{55 \times 3 \times 4}{6} = 55 \times 1 \times 2 = 110$, for the part wanting; which, taken from 1005, leaves 895 for the required number.

PINTLE, in *artillery*, a long iron bolt, fixed upon the middle of the limber bolſter, to go through the hole made in the trail-tranſom of a field-carriage, when it is to be tranſported from one place to another. See Carriage.

Pintle-*plate*, is a flat iron, through which the pintle paſſes, and nailed to both ſides of the bolſter, with 8 diamond-headed nails.

Pintle-*waſher*, an iron ring through which the pintle paſſes, placed cloſe to the bolſter for the trail to move upon.

Pintle-*hole*, is of an oval figure, made in the trail-tranſom of a field-carriage, wider above than below, to leave room for the pintle to play in.

Pintle-*plates*, one above and one below the pintle-hole, with a ring at the end, nailed to the trail-tranſom, with diamond-headed nails.

PIN, an iron nail or bolt, with a round head, and generally with a hole at the end to receive a key: there are many ſorts, as axle-tree pins, or bolts, bolſter-pins, pole-pins, ſwing-tree pins, &c.

PIONEERS, in *war-time*, are ſuch as are commanded in from the country, to march with an army, for mending the ways, for working on intrenchments and fortifications, and for making mines and approaches: the ſoldiers are likewiſe employed in all theſe things.

Moſt of the foreign regiments of artillery have half a company of pioneers, well inſtructed in that important branch of duty. Our regiments of infantry and cavalry have 3 or 4 pioneers each, provided with aprons, hatchets, ſaws, ſpades, and pick-axes.

PISTOL, the ſmalleſt piece of fire-arms, uſed by the cavalry, and borne on the ſaddle-bow.

To Pitch *tents.* See Tents.

PLACARD, } or, as it is in the original
PLAGART, } Dutch language, *Placaat*, a term uſed abroad for a proclamation, edict, &c. put up in all public places, by government authority; whereby their ſubjects are ordered to do, or forbear, ſomething expreſſed therein.

PLACE, in *fortification*, ſignifies in general terms a fortified town, a fortreſs: hence we ſay it is a ſtrong place.

Place *of arms in a town*, a place left near its centre, where generally the grand guard is placed. In towns regularly fortified, the place of arms should be in the centre. In this place the soldiers of the garrison parade, form, and mount guard, &c.

Place *of arms of an attack, or of a trench*, are deep trenches 15 or 18 feet wide, joining the several attacks together: they serve to place the guard of the trenches in, to be at hand to support the workmen when attacked. It is customary to make 3 places of arms, when the ground will permit: the first, and most distant from the place, is about 300 toises from the glacis of the covert-way; the second is within 140 toises; and the third at the foot of the glacis. See Parallels.

Place *of arms of a camp*, is, strictly speaking, the bell-tents, at the head of each company, where the arms are lodged; likewise a place chosen at the head of the camp for the army to form in line of battle, for a review, or the like.

Place *of arms of the covert-way*, is a part of it, opposite to the re-entering angle of the counterscarp, projecting outwards in an angle.

PLAN, *ground plot*, or *ichnography*, in *fortification*, is the representation of the first or fundamental tract of a work, showing the length of its lines, the quantity of its angles, the breadth of the ditches, thickness of the rampart and parapets, and the distance of one part from another: so that a plan represents a work, such as it would appear if cut equal with the level of the horizon, or cut off at the foundation: but it marks neither the heights nor depths of the several parts of the works: this is properly *profile*, which expresses only the heights, breadths, and depths, without taking notice of the lengths. As architects, before they lay the foundation of their edifice, make their design on paper, by which means they find out their faults; so an engineer, before tracing his works on the ground, should make *plans* of his designs upon paper, to the end he may do nothing without serious deliberation.

Exact plans are very useful for generals or governors, in either attacking or defending a place, in chusing a camp, determining attacks, conducting the approaches, or in examining the strength and weakness of a place; especially such plans as represent a place with the country about it, showing the rivers, fountains, marshes, ditches, valleys, mountains, woods, houses, churches, defiles, roads, and other particulars, which appertain to it.

PLANKS. See Madriers.

PLATES, or *prise-plates*, in *artillery*, two plates of iron on the cheeks of a gun-carriage, from the cope-square to the centre, through which the prise-bolts go, and on which the hand-spikes rest, when used in raising the breech of the gun, &c.

Breast-Plates, the two plates on the face of the carriage, on the other cheek.

Train-Plates, the two plates on the cheeks at the train of the carriage.

Dulidge-Plates, the six plates on the wheel of a gun-carriage, where the fellies are joined together.

PLATFORM, in *gunnery*, is a bed of wood on a battery, upon which the guns stand; each consisting of 18 planks of oak or elm, a foot broad, 2½ inches thick, and from 8 to 15 feet long, nailed or pinned on 4, 5, or 6 beams, from 4 to 7 inches square, called sleepers. They must be made higher behind than before by 6 or 9 inches, to prevent too great a recoil, and to advance the gun easy when loaded. They are from 18 to 20 feet long, 8 feet before and 14 or 15 feet behind, and the direction left to the officers of the royal regiment of artillery.

PLATOON, in *military affairs*, a small body of men, in a battalion of foot, &c. that fire alternately. A battalion is generally divided into 16 platoons, exclusive of the grenadiers, which form 2 or 4 platoons more, as occasion may require.

PONIARD, a sort of short sword, used in Spain, Portugal, and Italy.

POINT-BLANK, *of a gun*, is the distance she throws a shot in a supposed direct line; the gun being laid at no elevation, but levelled parallel to the horizon. We say, supposed direct line, because it is certain, and easily proved, that a shot cannot fly any part of its range in a right line strictly taken; but the greater the velocity, the nearer it approaches to a right line; or the less crooked its range.

POINTING *of a gun or mortar*, is the placing either one or other, so as to hit the object, or to come as near it as possible.

POLE, in a 4-wheel carriage, is fastened to the middle of the hind axle-tree, and passes between the fore axle-tree and its bolster, fastened with the pole-pin, so as to move about it, and fastens the fore and hind carriages together.

POLYGON, is a figure of more than four sides, and is either regular or irregular, exterior or interior.

Regular Polygon, is that whose angles and side are equal. It has an angle of the centre, and an angle of the polygon. The centre of a regular

gular polygon, is the centre of a circle, which circumſcribes the polygon; that is, whoſe circumference paſſes through all the angles of the figure.

Irregular POLYGON, is that whoſe ſides and angles are unequal.

Exterior POLYGON, that whoſe lines touch the points of the flanked angles, when a place is fortified inwards.

Interior POLYGON, that outward fortification which makes the angles of the gorge; ſo that the whole baſtion is without the polygon.

PONT *de jonc*, or *Pont volant*. See BRIDGE.

PONTOON, in *war*, a kind of flat-bottomed boat, whoſe carcaſs of wood is lined within and without with tin: they ſerve to lay bridges over rivers for the artillery and army to march over. The French pontoons, and thoſe of moſt other powers, are made of copper on the outſide: though they coſt more at firſt, yet they laſt much longer than thoſe of tin; and, when worn out, the copper ſells nearly for as much as it coſt at firſt; but when ours are rendered uſeleſs, they ſell for nothing. Our pontoons are 21 feet long, 5 feet broad, and depth within 2 feet 1.5 inches.

PONTOON-*carriage*, is made with two wheels only, and two long ſide-pieces, whoſe fore ends are ſupported by a limber; and ſerves to carry the pontoon, boards, croſs timbers, anchors, and every other thing neceſſary for making a bridge.

PONTOON-*bridge*, is made of pontoons, ſlipped into the water, and placed about 5 or 6 feet aſunder; each faſtened with an anchor, when the river has a ſtrong current, or to a ſtrong rope that goes acroſs the river, running through the rings of the pontoons. Each boat has an anchor, cable, baulks, and cheſts. The baulks are about 5 or 6 inches ſquare, and 21 feet long. The cheſts are boards joined together by wooden bars, about 3 feet broad, and 12 feet long. The baulks are laid acroſs the pontoons at ſome diſtance from one another, and the cheſts upon them joined cloſe; which makes a bridge, in a very ſhort time, capaple of ſupporting any weight.

PORT-*cullice*, in *fortification*, is an aſſemblage of ſeveral large pieces of wood, joined acroſs one another like a harrow, and each pointed with iron at the bottom. They are ſometimes hung over the gate-way of old fortified towns, ready to let down in caſe of a ſurpriſe, when the gates could not be ſhut.

PORT-*fire*, in *artillery*, a compoſition put in a paper caſe to fire guns and mortars, inſtead of a lint-ſtock and match. See LABORATORY WORKS.

POST, in *war*, any ſort of ground, fortified or not, where a body of men can be in a condition of reſiſting the enemy.

Advanced POST, a ſpot of ground, ſeized by a party to ſecure their front, and the poſts behind them.

POST *of honour*. The advanced guard is a poſt of honour: the right of the two lines is the poſt of honour, and is always given to the eldeſt regiment: the left is the next poſt, and is given to the next eldeſt, and ſo on. The centre of the lines is the poſt the laſt honourable, and is given to the youngeſt regiments. A ſentinel placed before the colours, and at the door of the commanding officer, is a poſt of honour.

POSTERN, more frequently called a ſally-port, is a ſmall door in the flank of a baſtion, or other part of a garriſon, to march in and out unperceived by an enemy, either to relieve the works, or make ſallies.

POUCH, in a *military ſenſe*, is a ſquare caſe or bag of leather, with a flap over it, pendent to a buff ſhoulder-belt, of about 3 inches broad, and hangs over the left ſhoulder of the infantry: its uſe is to hold cartridges, &c. They are made of the ſtouteſt, blackened calf-ſkin, eſpecially the outſide flaps, which ſhould be of ſuch a ſubſtance, as to turn the ſevereſt rain. The cartridge-boxes in the inſide of the pouches, to be made as light as poſſible, with 36 holes in each, in order to prevent the addition of boxes to buckle round the waiſt, which has often been productive of miſchief and confuſion, by blowing-up.

POUNDER, in *artillery*, is uſed to ſpecify a certain caliber: thus a 24-pounder, a 12 or a 6-pounder, are thoſe pieces whoſe balls weigh 24, 12, or 6 pounds.

POWDER. See GUN-POWDER.

POWDER-*magazine*, a bomb-proof arched building to hold the powder in fortified places, &c. containing ſeveral rows of barrels laid one over another. See MAGAZINE.

POWDER-*cart*, a two-wheel carriage, covered with an angular roof of boards; and, to prevent the powder from dampings, a tarred canvaſs is put over the roof: on each ſide are lockers to hold ſhot, in proportion to the quantity of powder, which is generally four barrels.

POWDER-*mill*, where the materials are beat, mixed

mixed together, and grained: they are placed near rivers, and as far from any house as can be, for fear of accidents, which often happen. See MILL.

POZOLANA. See MORTAR.

PRACTICE, or *gun-practice*. In the spring, as soon as the weather permits, the exercise of the great guns begins, with an intention to show the gentlemen cadets at the royal military academy at Woolwich, and private men, the manner of laying, loading, pointing, and firing the guns. Sometimes instruments are used to find the centre line, or two points, one at the breech, the other at the muzzle, which are marked with chalk, and whereby the piece is directed to the target: then a quadrant is put into the mouth, to give the gun the required elevation, which at first is guessed at, according to the distance the target is from the piece. When the piece has been fired, it is sponged, to clear it from any dust or sparks of fire that might remain in the bore, and loaded: then the centre line is found, as before; and if the shot went too high, or too low, to the right or to the left, the elevation and trail are altered accordingly. This practice continues morning and evening for about six weeks, more or less, according as there are a greater or less number of recruits. In the mean time others are shown the motions of quick firing with field-pieces.

Mortar-PRACTICE, generally thus: a line of 1500 or 2000 yards is measured in an open spot of ground, from the place where the mortars stand, and a flag fixed at about 300 or 500 yards: this being done, the ground where the mortars are to be placed is prepared and levelled with sand, so that they may lie at an elevation of 45 degrees; then they are loaded with a small quantity of powder at first, which is increased afterwards, by an ounce every time, till they are loaded with a full charge: the times of the flights of the shells are observed, to determine the length of the fuzes. The intention of this practice is, when a mortar-battery is raised in a siege, to know what quantity of powder is required to throw the shells into the works at a given distance, and to cut the fuzes of a just length, that the shell may burst as soon as it touches the ground.

PRAME, in *military history*, a kind of floating battery, being a flat-bottomed vessel, which draws little water, mounts several guns, and is very useful in covering the disembarkation of troops. They are generally made use of in transporting the troops over the lakes in America.

PRIEST's-*cap*. See FORTIFICATION, and BONNET.

PRIMING, in *gunnery*, is the gun-powder put into the pan of small arms, and into the vent of cannon, that the powder may thereby be inflamed.

PRISONERS *of war*, those of the enemy who are taken in or after a battle, siege, &c.: they are deprived of their liberty at large, until exchanged.

PROFILE, in *fortification*, is the representation of a vertical section of a work, and serves to show those dimensions which cannot be represented in plans, but are yet necessary in the building of a fortification: they are best constructed on a scale of 30 feet to an inch. See Pl. XIV. *fig.* 1, 2, 3, 4, 5, &c.

PROOF *of artillery and small arms*, is a trial whether they will stand the quantity of powder allotted for that purpose. The rule of the board of ordnance is, that all guns, under 24-pounders, be loaded with powder as much as their shot weighs; that is, a brass 24-pounder with 21 lb. a brass 32-pounder with 26 lb. 12 oz. and a 42-pounder with 31 lb. 8 oz.; the iron 24-pounder with 18 lb. the 32-pounder with 21 lb. 8 oz. and the 42-pounder with 25 lb.

The brass light field-pieces are proved with powder that weighs half as much as their shot, except the 24-pounder, which is loaded with 10 lb. only.

Government allows 11 bullets of lead in the pound for the proof of muskets, and 14.5, or 29 in two pounds, for service; 17 in the pound for the proof of carabines, and 20 for service; 28 in the pound for the proof of pistols, and 34 for service.

When guns of a new metal, or of lighter construction, are proved, then, besides the common proof, they are fired 2 or 300 times, as quick as they can be, loaded with the common charge given in actual service. Our light 6-pounders were fired 300 times in 3 hours 27 minutes, loaded with 1 lb. 4 oz. without receiving any damage.

PROOF *of powder*, is in order to try its goodness and strength. There have been different inventions proposed and put in practice heretofore, for the proof of powder. See GUN-POWDER.

PROOF *of cannon*, is made to ascertain their being well cast, their having no cavities in their metal, and, in a word, their being fit to resist the effort of their charge of powder. In making this proof, the piece is laid upon the ground, supported only by a piece of wood in the middle, of about 5 or 6 inches thick, to raise the muzzle

a little; and then the piece is fired against a solid butt of earth.

Tools to PROVE *cannon are as follow:*

Searcher, is an iron socket with branches, from 4 to 8 in number, bending outwards a little, with small points at their ends: to this socket is fixed a wooden handle, from 8 to 12 feet long, and 1½ inch in diameter. This searcher is introduced into the gun after each firing, and turned gently round to discover the cavities within: if any are found, they are marked on the outside with chalk; and then the

Searcher with one point is introduced, about which point a mixture of wax and tallow is put, to take the impression of the holes; and if any are found of ¼ of an inch deep, or of any considerable length, the gun is rejected as unserviceable to the government.

Reliever, is an iron ring fixed to a handle, by means of a socket, so as to be at right angles: it serves to disengage the first searcher, when any of its points are retained in a hole, and cannot otherwise be got out. When guns are rejected by the proof-masters, they order them to be marked ✕ thus, which the contractors generally alter *WP* thus, and after such alteration, dispose of them to foreign powers for Woolwich proof.

The most curious instrument for finding the principal defects in pieces of artillery, was lately invented by lieutenant-general Desaguliers, of the royal regiment of artillery. This instrument, grounded on the truest mechanical principles, is no sooner introduced into the hollow cylinder of the gun, than it discovers its defects, and more particularly that of the piece not being truely bored, which is a very important one, and to which most of the disasters happening to pieces of artillery, are in a great measure to be imputed; for, when a gun is not truely bored, the most expert artillerest will not be able to make a good shot. *See the following tables.*

Weight of powder for PROOF, *service, and scaling brass and iron guns.*

Pounders	Brass guns																	
	Heavy						Medium						Light					
	Proof		Service		Scaling		Proof		Service		Scaling		Proof		Service		Scaling	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
42	31	8	21	0	3	4												
32	26	12	16	0	2	12												
24	21	0	12	0	2	0	18	0	9	0	2		10	0	5	0	2	
18	18	0	9	0	1	8												
12	12	0	6	0	1	0	9	0	4	0	1		6	0	3	0	1	
9	9	0	4	8	0	12												
6	6	0	3	0	0	8	6	0	3 2	or 0 8		8	3	0	1	8		8
4	4	0	2	0	0	6												
3	3	0	1	8	0	4	3	0	1	8		4	1	8	0	12		4
2	2	0	1	0	0	3												
1½	1	8	0	12	0	2												
1	1	0	0	8	0	1½												
½	0	8	0	4	0	1												

Iron

Pounders	Iron guns																	
	Heavy						Medium						Light					
	Proof		Service		Scaling		Proof		Service		Scaling		Proof		Service		Scaling	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
42	25	0	17	0	3	4							22	3	14		3	4
32	21	8	14	0	2	12							19	1	10	10	2	12
24	18	0	11	0	2	0							16		8		2	
18	15	0	9	0	1	8							13	5	6		1	8
12	12	0	6	0	1	0							10	10	4		1	
9	9	0	4	8	0	12							8	8	3			12
6	6	0	3	0	0	8	4	0	2	0		8	5	5	2			8
4	4	0	2	0	0	6							3	8	1	10		6
3	3	0	1	8	0	4							2	10	1			4
2	2	0	1	0	0	3							1	12		10		3
1½	1	8	0	12	0	2							1	5		7		2
1	1	0	0	8	0	1½								14		4½		1½
½	0	8	0	4	1	1								7		2¼		1

Proof *of mortars and howitzers,* is made to ascertain their being well cast, and of strength to resist the effort of their charge. For this purpose the mortar or howitzer is placed upon the ground, with some part of their trunnions or breech sunk below the surface, and resting on wooden billets, at an elevation of about 70 degrees.

The mirror is generally the only instrument to discover the defects in mortars and howitzers. In order to use it, the sun must shine; the breech must be placed towards the sun, and the glass over-against the mouth of the piece: it illuminates the bore and chamber sufficiently to discover the flaws in it. See the following table.

Weight of powder for Proof, *scaling, and blowing of mortars, howitzers, royals, and coehorns, &c.*

Nature	Proof		Scaling		blowing		Shells contain powder			Cham contain powder		Shells weight
inches	lb.	oz.	oz.	dr.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	lb.
13 S.	30	0	2	0	2	0	9	4	8	32	0	198
10 S	10	4	1	0	1	0	4	14	12	12	8	93
13 L	9	8	2	0	2	0	9	4	8	9	1	194
10 L.	3	14	1	0	1	0	4	14	12	4	0	90
8 L.	2	0	1	0	1	0	2	3	8	2	1	46
5½ R.	0	9	0	12	0	12	1	1	8	1	0	16
4⅖ C.	0	4½	0	8	0	8	0	8	0	0	8	9
10 H.	4	0	1	8	1	8	4	14	12	4	0	90
8 H.	3	8	1	0	1	0	2	3	8	2	0	46
5½ H.	1	0	0	12	0	12	1	1	8	1	0	16
4⅖ H.	0	8	0	8	0	8	0	8	0	0	8	8

N. B. S. stands for sea-mortar, L. for land-mortar, R. for royal, C. for coehorn, and H. for howitzer. The weight of the shells, and quantity of powder to fill them, differ sometimes considerably.

Proof *of small arms with leaden balls.*

Nature of pieces	Balls for proof		Balls for service.		Wt. of powder in service
	N°. in 1 lb.	Wt. of each	N°. in 1 lb.	Wt. of each.	
Wall-piece	6	oz. dr. 2 8	$6\frac{2}{5}$	oz. dr. 2 8	oz. dr. 0 12
Musket	11	1 $7\frac{3}{11}$	$14\frac{1}{2}$	1 $1\frac{19}{29}$	0 6
Carbine	17	0 $15\frac{1}{17}$	20	0 $12\frac{4}{5}$	0 $4\frac{1}{2}$
Pistol	28	0 9[illegible]	34	0 7[illegible]	0 $2\frac{1}{2}$

N. B. In the proof of all sorts of small arms, the quantity of powder used is the weight of the ball exactly.

Proof *of foreign brass artillery.*

1st. The *Prussians*. Their battering-train and garrison artillery are proved with a quantity of powder equal to $\frac{1}{2}$ the weight of the shot, and fired 75 rounds as fast as in real service; that is, 2 or 3 rounds in a minute.

Their light field-train, from a 12-pounder upwards, are proved with a quantity of powder = 1-3d of the weight of the shot, and fired 150 rounds, at 3 or 4 rounds in a minute. From a 12-pounder downwards, are proved with a quantity of powder = 1-5th of the shot's weight, and fired 300 rounds, at 5 or 6 rounds each minute, properly sponged and loaded.

Their mortars are proved with the chambers full of powder, and the shells loaded. Three rounds are fired as quick as possible.

2d. The *Dutch* prove all their artillery by firing each piece 5 times; the two first rounds with a quantity of powder = 2-3ds of the weight of the shot; and the three last rounds with a quantity of powder = $\frac{1}{2}$ the weight of the shot.

3d. The *French* the same as the Dutch.

4th. The *Portuguese* prove their artillery as follows, viz.

42, 32, 24	Pounders, 6 rounds	1st shot 30lb. 1st shot 26lb. 1st shot 18lb.	then diminishing 2lb. each round
12, 6, 3	Pounders, 6 rounds	1st shot 10lb. 1st shot 5lb. 1st shot $2\frac{1}{2}$lb.	dimin. 1lb. each round —— $\frac{1}{2}$lb. each round —— $\frac{1}{4}$lb. each round

They are only fired once in every minute.

Their mortars are proved by filling the chambers full of powder, a loaded shell, and the mortar rammed full of earth.

PROJECTILES, are such bodies as, being put in a violent motion by any great force, are then cast off, or let go from the place where they received their quantity of motion; as a shell or shot from a piece of artillery, a stone thrown from a sling, or an arrow from a bow, &c. This line is commonly taken for a parabola, and the ranges are computed from the properties of that curve. The assumption would be just, in case the ball, in its motion, met with no resistance: but, the resistance of the air to swift motions being very great, the curve described by the shot is neither a parabola, nor near it: and by reason of the resistance, the angle which gives the greatest amplitude is not 45 degrees, as commonly supposed, but something less, probably $43\frac{1}{2}$. Hence the sublime mathematics are absolutely necessary in the investigation of the track of a shell or shot in the air, known by the name of *military projectiles*.

Galileus having discovered that bodies projected in vacuo, and in an oblique direction to the horizon, do always describe a parabola; it was observable, that this doctrine was not sufficient to determine the real motion of a military projectile: for since shells and shot move with a great velocity, the resistance of the air becomes so great with respect to the weight of the projectile, that its effect turns the body very considerably from the parabolic tract; so that all calculations, grounded on the nature of this curve, are of little use on these occasions. This is not to be wondered at. since Galileus, in his enquiry, paid no regard to any other force acting on bodies, than the force of gravity only, without considering the resistance of the air.

Every body, moving in a fluid, suffers the action of two forces: the one is the force of gravity, or the weight of the body; and it is to be observed, that this weight is less than the natural weight of the body, that being diminished by an equal bulk of the fluid in which the body moves. The other force is that of the resistance, which is known to be proportional to the squares of the velocity of the body; and when the body is a globe, as is commonly supposed, the direction of this force is diametrically opposite to that of the motion of the body. This force changes continually, both in quantity and direction; but the first force remains constantly the same. Hence, the point in question is, to determine the curve which a body projected obliquely, must describe when acted upon by the two forces just now mentioned.

Although

Although this question is easily reduced to a problem purely analytical, the great Newton, notwithstanding his ingenious endeavours, did not arrive at a complete solution of it. He was the first who attempted it, and having succeeded so well in the supposition, that the resistance is proportional to the velocity, it is almost inconceivable that he did not succeed, when the resistance is supposed proportional to the squares of the velocity, after solving a number of questions incomparably more difficult. The late Mr. John Bernoulli gave the first solution of this problem, from which he drew a construction of the curve, by means of the quadratures of some transcendent curves, whose description is not very difficult.

This great problem was, therefore, very well solved long ago; yet the solution, however good in theory, is such as has hitherto been of no use in practice, nor in correcting the false theory grounded on the parabola, to which the artillerist is still obliged to adhere, notwithstanding he knows it to be insufficient. It is certain, that that solution has been of no real advantage towards improving the art of gunnery: it has only served to convince the student in that art, of the error of his principles, drawn from the nature of the parabola, although he is still to abide by them. It is indeed something, to know that the common rules are erroneous; but unless we know how much they err in any case, the advantage is very little.

One may think it a work of infinite labour to establish rules for the flight of cannon-shot, agreeable to the real curve which a body describes in the air: for although, according to the hypothesis of Galileus, we want only the elevation of the piece, and the initial velocity, and it is therefore not difficult to calculate tables to show the greatest height of the projectile, and the point where it must fall in any proposed case; yet in order to calculate similar tables according to the true hypothesis, care must be taken, besides the two particulars already mentioned, to have respect as well to the diameter of the projectile as to its weight: therefore the practitioner will be reduced to the necessity of calculating tables, as well for the diameter of each projectile, as for its weight; and the execution of such a work would be almost impracticable. We therefore refer the curious to Mr. Euler's *True Principles of Gunnery*, translated, with many necessary explanations and remarks, by the very learned and ingenious Hugh Brown, esq;.

That the reader may have a clear conception of the different conclusions deduced from this, and from the common theory, I shall here subjoin a table of the greatest range, and the ranges at 45 degrees by this theory; and also the ranges at 45 degrees by the common theory; the initial velocity being the same.

Comparison of the ranges by this theory, with those determined by the common theory, which supposes a vacuum, the initial velocity being given, &c.

Velocity per second in feet	For the greatest range by this theory						Range at 45° by this theory			Range at 45° in vacuo
	12¾-inch shell		9¾-inch shell		7¾-inch shell					
	Limits of elevation between	Range in feet something more than	Limits of elevation between	Range in feet something more than	Limits of elevation between	Range in feet something more than	12¾-in shell	9¾-inch shell	7¾-inch sheil	Feet
	° ′ ″ ° ′ ″		° ′ ″ ° ′ ″		° ′ ″ ° ′ ″					
600	40 0 15 & 43 12 33	6748.040	39 33 5 & 41 6 53	6098.36	39 4 9 & 41 6 53	5646.94	6680.505	6061.82	5582.62	11191.7
900	39 4 9 40 32 18	10631.57	36 37 1 38 0 26	9446.72	35 5 21 36 27 33	8405.97	10370.06	9218.50	8206.39	25181.3
1200	34 27 40 36 27 33	13928.49	33 44 52 35 38 12	12301.48	33 44 52 35 2 58	10581.91	13442.88	11530.65	9987.27	44766.8
1500	33 44 52 35 2 58	16558.45	33 16 6 34 33 35	14085.96	32 27 50 34 33 35	12303.43	15629.30	13494.96	11695.36	69948.2
1800	32 27 50 34 33 35	18762.77	30 48 50 32 51 59	15854.64	30 48 50 31 54 56	13685.41	18114.09	14712.06	12403.80	100725.4
2200	30 48 50 32 51 39	20706.91	30 48 50 31 54 56	17816.56	29 53 5 31 4 15	14847.49	19337.07	16012.82	13782.98	137098.4
2400	30 48 50 31 54 56	22129.69	29 0 9 31 4 15	18468.56	29 0 9 31 4 15	16026.99	20613.40	17139.99	14436.90	199067.3
2[illegible]0	29 53 5 31 4 15	23604.66	29 0 9 31 4 15	19787.96	—— ——	——	21889.72	18018.94	——	226632.2

Experiments intended to try the ranges computed by this theory, with those determined by the common theory, at Gibraltar, in 1766, communicated to me by Capt. Jardine.

10-inch howitzer

Weight 30 C. Weight shell 90lb.
Length of chase $28\frac{1}{4}$ in. Length chamb. $16\frac{1}{2}$ in.
Diam. chamber 6.65 Windage .3 inches.

Elevation	Powder		Ranges real	Mediums	Should be by the new theory.	Should be by the parabola
°	lb.	oz.	yards	yards	yards	yards
45	2		967, 970	$968\frac{1}{2}$	916	1028
	1	12	816, 826, 845, 836	830	772	880
	1	8	670, 718, 637, 662, 666	660	600	640
9	2		318, 324, 302	314	330	294
	1	12	270, 250, 292	270	290	250
12	1	8	271, 259, 251, 263	260	285	254

8-inch howitzer

Wt. howitzer $11\frac{3}{4}$ C. Weight of shell 48 lb.
Length chase $25\frac{1}{4}$ in. Length chamb. $9\frac{1}{4}$ in.
Diam. chamb. 4.8 in. Windage .3 inches.

Elevation	Powder		Ranges real	Mediums	Should be by the new theory	Should be by the parabola.
°	lb.	oz.	yards	yards	yards	yards
45	1		1000, 935, 1020	985	941	1102
		14	794, 880	837	800	920
		12	718, 670, 672, 662, 695, 685	683	635	690
9	1		361, 356, 307	340	356	300
		14	287, 297, 265	283	290	256
12		12	274, 300, 280, 276	280	248	276

In these experiments, from the ranges at 45 degrees elevation, it was calculated what those at 9° and 12° should be; and from those lower elevations, what the higher should be: first by Mr. Robins's theory in column fifth, then by the usual way, supposing the curve a parabola, in the last column.

It must be confessed that these experiments are not so decisive as could be wished, for want of time, and of a sufficient range, &c. to give a fair trial to Mr. Robins's principles; for, as the ranges increase, the errors of the parabolic theory would likewise increase; which, in Mr. Robins's method, probably is not the case: but a more simple and less tedious manner of applying it to practice is still wanting; which perhaps might be done by the help of more tables, &c.

Military PROJECTILE *demonstrated.* Let (*fig.* 1. Pl. XIII.) *CNAMH* be the curve described by a globe in any fluid; and let *a* denote the accelerate force of gravity, and let *c* be the retardive force of the resistance. Let *A* be the highest point of the curve, and the horizontal line *BAE* a tangent in that point. *CAN* will be a portion in that curve, by which the globe ascends, and *AMH* that by which it descends. Let us consider separately the motion in the ascent and descent; and for the descent, let any abscissa taken on the horizontal line $AP = x$, and

, and the corresponding vertical ordinate $PM = y$; and let v denote the distance a body must fall freely to acquire the velocity of the globe at M, and the retardive force of resistance at M will be $= \frac{v}{c}$.

Resolving the motion of the body into the horizontal direction AP, and the vertical direction PM, this will be accelerated by the accelerative force of gravity a. The retardive force of the resistance $\frac{v}{c}$ acting in the direction of the tangent MT, if we put the fluxion of the curve $Mm = \dot S$, there will result a force which opposes the horizontal motion $= \frac{v\dot x}{c\dot S}$. Therefore, if the fluxion of the time be denoted by $\dot t$, so $\dot t = \frac{\dot S}{\sqrt{v}}$, and $\dot t$ be supposed constant, the mechanical principles of acceleration furnish these two equations: $\frac{2\ddot x}{\dot t^2} = -\frac{v\dot x}{c\dot S}$; and $\frac{2\ddot y}{\dot t^2} = a - \frac{v\dot y}{c\dot S}$.

Since $\dot t = \frac{\dot S}{\sqrt{v}}$, we have $v = \frac{\dot S^2}{\dot t^2}$, whence the foregoing equations become: $\frac{2\ddot x}{\dot t^2} = -\frac{\dot x\dot S}{c\dot t^2}$, and $\frac{2\ddot y}{\dot t^2} = a - \frac{\dot y\dot S}{c\dot t^2}$. Suppose $\dot y = p\dot x$, so that p denote the tangent of the angle PTM, or of the inclination of the globe's motion to the horizon; then because $\dot S = \dot x\sqrt{1+p^2}$, and $\ddot y = p\ddot x + \dot x\dot p$, we shall have these two equations: $\frac{2\ddot x}{\dot t^2} = -\frac{\dot x^2\sqrt{1+p^2}}{c\dot t^2}$, and $\frac{2p\ddot x}{\dot t^2} + \frac{2\dot x\dot p}{\dot t^2} = a - \frac{p\dot x^2\sqrt{1+p^2}}{c\dot t^2}$; and the first multiplied by p, and taken from the last, leaves $\frac{2\dot x\dot p}{\dot t^2} = a$, or $a\dot t^2 = 2\dot x\dot p$; and since the first gives $-\frac{2\ddot x}{\dot x^2} = \frac{\sqrt{1+p^2}}{c}$, we find $v = \frac{\dot x^2 \times \overline{1+p^2}}{\dot t^2}$

$c\ \dot x \times 1p^2$

Because $2\dot p = \frac{a\dot t^2}{\dot x}$; the other equation $-\frac{2\ddot x}{\dot x^2} = \frac{\sqrt{1+p^2}}{c}$, multiplied by $\dot p$, is reduced to $-\frac{2a\dot t^2\ddot x}{\dot x^3} = \frac{2\dot p\sqrt{1+p^2}}{c}$, whose fluent, $\dot t$ being constant, is $\frac{a\dot t^2}{\dot x^2} = \frac{2\dot p}{\dot x} = 2C + \frac{2}{c}$ into the fluent of $\dot p\sqrt{1+p^2}$; from which we deduce $\dot x = \frac{\dot p}{C + \frac{1}{c} \times \text{fluent of } \dot p\sqrt{1+p^2}}$ and $\dot y = \frac{p\dot p}{C + \frac{1}{c} \times \text{fluent of } \dot p\sqrt{1+p^2}}$; therefore $\dot S = \dot x\sqrt{1+p^2} = \frac{\dot p\sqrt{1+p^2}}{C + \frac{1}{c} \times \text{fluent of } \dot p\sqrt{1+p^2}}$. Finally, because $a\dot t^2 = 2\dot x\dot p$, we shall have $\frac{1}{2}a\dot t^2 = \frac{\dot p^2}{C + \frac{1}{c} \times \text{fluent of } \dot p\sqrt{1\times p^2}}$, and $\dot t\sqrt{\frac{1}{2}a} = \frac{\dot p}{\sqrt{C + \frac{1}{c} \times \text{fluent of } \dot p\sqrt{1+p^2}}}$, and, finally, for the velocity $v = \frac{\frac{1}{2}a \times \overline{1+p^2}}{C + \frac{1}{c}\text{ fluent of } \dot p\sqrt{1+p^2}}$.

It is evident, that the expressive fluent of $\dot p\sqrt{1+p^2}$ in the foregoing equations, expresses a parabolic arc; or it may be assigned by logarithms, since the fluent of $\dot p\sqrt{1+p^2} = \frac{1}{2}p\sqrt{1+p^2} + \frac{1}{2}\log. p + \sqrt{1+p^2}$; taking the fluent so that it may vanish when $p = o$, which is the case at the vertex of the curve, where the tangent is horizontal: therefore, supposing the angle of the inclination of the body's motion to the horizon, whose tangent is $= p$, to be known at the point M, we find the abscissa $AP = x$, the ordinate $PM = y$, the arc $AM = s$, the height answering to the velocity at M, and finally the time of describing the arc AM.

Put the quantity C, which is introduced into the fluent, equal to the fraction $\frac{n}{c}$, it is manifest, that n denotes an abstract number. Let, for brevity sake, the fluent of $\dot p\sqrt{1+p^2} = P$. Since the value of P is easily found for every value of p, we shall have the following equations for the branch AMH, by which the body descends:

deſcends: $x = c \times$ fluent of $\frac{\dot{p}}{n+P}$; $y = c \times$ fluent of $\frac{p\dot{p}}{n+P}$, $S = c \times$ fluent of $\frac{\dot{p}\sqrt{1+p^2}}{n+P}$; $\dot{t}\sqrt{\tfrac{1}{2}a} = \frac{\dot{p}\sqrt{c}}{\sqrt{n+P}}$, or $t = \frac{\sqrt{2c}}{\sqrt{a}} \times$ fluent of $\frac{}{\sqrt{n+P}}$ and $v = \frac{\frac{1}{2}ac \times \overline{1+p^2}}{n+P}$. Theſe fluents are to be taken ſo, that they may vaniſh in the caſe where $p = o$; whence it appears that the height anſwering to the velocity at A will be $\frac{ac}{2n}$.

The ſame equations ſerve to expreſs the nature of the other branch ANC, which the body deſcribes in its aſcent, by taking the value of P negative: therefore, if the direction of the motion at N make, with the horizontal line, an angle whoſe tangent is p, we ſhall have $AQ = c \times$ fluent of $\frac{\dot{p}}{n-P}$; $QN = c \times$ fluent of $\frac{p\dot{p}}{n-P}$ $AN = c \times$ fluent of $\frac{p\sqrt{1+p^2}}{n-P}$; and the time of deſcribing the arc $AN = \frac{\sqrt{2c}}{\sqrt{a}} \times$ fluent of $\frac{}{\sqrt{n-P}}$, and the height anſwering to the velocity at N $\frac{\frac{1}{2}ac \times 1+p^2}{n-P}$. Whence it is evident, that in the aſcending branch ANC, the inclination of the tangent to the horizon can no where become ſo great, that P ſhall be greater than n, and that when $P = n$ the velocity of the body is infinite.

The velocity of the body, and $CNAMH$ which it deſcribes, depend on three conſtant quantities, a, c, and n; whoſe values muſt be found for every caſe propoſed. The firſt, a, is determined from the relation of the ſpecific gravity of the fluid to that of the globe; and ſince it does not come into the expreſſions which determine the nature of the curve, that will be known independent of a: it is only the time and velocity which depend upon it. The quantity c is found by means of the diameter and weight of the globe; and, as it is uſed only as a multiplier, it cauſes no difficulty in the calculation. But the third quantity n, which depends on the velocity, affects our expreſſions in ſuch a manner, that they muſt be calculated ſeparately for all the different values of n.

In order to unfold more fully the nature of this curve, it is neceſſary to conſider the radius or curvature, which meaſures its curvature at any point. Now, if $\dot{y} = \dot{p}\,x$, the radius of curvature is known to be $\frac{\dot{x} \times \overline{1+p^2} \times \sqrt{1+p^2}}{\dot{p}}$. Therefore, ſince $\frac{\dot{x}}{\dot{p}} = \frac{c}{n+P}$ for the deſcending branch, the radius of curvature at M will be $= \frac{c \times \overline{1+p^2} \times \sqrt{1+p^2}}{n+P}$. And for the aſcending branch, where $\dot{y}$ is alſo $= p\,\dot{x}$, the radius of curvature at N will be $= \frac{c \times \overline{1+p^2} \times \sqrt{1+p^2}}{n-P}$. Therefore, when $P = n$, and the velocity of the body infinitely great, the radius of curvature becomes infinitely great alſo; and it appears, that in theſe two branches, where the tangents are equally inclined to the horizon, the radius of curvature, and alſo the other quantities x, y, s, t, and v, are greater in the aſcending than in the deſcending branch.

Therefore, in a reſiſting medium, the two branches of the curve are diſſimilar, ſo that the curvature is greateſt in the deſcending branch, and the motion ſwifteſt in the aſcending branch. But when there is no reſiſtance, it is known that the two branches are equal and ſimilar, and alſo the motion the ſame in both; for, in vacuo, the quantity c becomes infinite, and ſo does the number n, ſince $\frac{ac}{2n}$ denotes the height anſwering to the velocity at A. Therefore P will be nothing in reſpect of n; and becauſe $a = 1$, if we put $\frac{c}{2n} = b$; we ſhall have for a non-reſiſting medium $x = 2bp$, $y = p^2$, $s = 2b \times$ fluent of $\dot{p}$ $\sqrt{1+p^2}$; $t = 2bp$; $v = b \times \overline{1+p^2}$; and the radius of the curvature $= 2b \times \overline{1+p^2}^{\frac{3}{2}}$. Whence it is evident, that the curve is a parabola, and the motion ſuch as it is generally allowed to be.

It is, therefore, from the quantity $P =$ the fluent of $\dot{p}\sqrt{1+p^2}$, that the difference ariſes between a trajectory in vacuo, and in a fluid; and, it is evident, that this difference will be ſo much

much greater, the greater P is in respect to n. Now the quantity P vanishes at the vertex A; and from thence, P increases as the angle MTP, which the tangent of the curve makes with the horizon, increases; so that when this becomes a right angle, the quantity P becomes infinite; consequently, how small soever the resistance be, the curve $CNAMH$ will at length deviate infinitely from a parabola; since, by continuing its branches, it must necessarily happen that the quantity P shall not only become equal to the number n, but at last infinitely exceed it.

PROVISIONS, in a *military sense*, implies all manner of eatables, food, or provender, used in an army, both for man and beast.

PROVOST-*Marshal*, of an army, is an officer appointed to secure deserters, and all other criminals: he is often to go round the army, hinder the soldiers from pillaging, indict offenders, execute the sentence pronounced, and regulate the weights and measures used in the army when in the field. He is attended by a lieutenant's guard, has a clerk, and an executioner.

PUNISHMENT, in the *army*, in general, signifies the execution of a sentence pronounced by a court-martial upon any delinquent; but in particular it means that kind of punishment often used by inflicting a certain number of lashes upon a non-commissioned officer, or private man.

PULLY, in *military mechanics*. See MECHANICS.

Q

QUADRANT, in *gunnery*, an instrument made of brass or wood, divided into degrees, and each degree into 10 parts, to lay guns or mortars to any angle of elevation.

The common sort is that whose radii projects the quadrant about 12 inches, and a plummet suspends in its centre, by means of a fine thread of silk; so that, when the long end is introduced into the piece, the plummet shows its elevation.

The best sort has a spiral level fixed to a brass radius; so that, when the long end is introduced into the piece, this radius is turned about its centre 'till it is level; then its end shows the angle of elevation, or the inclination from the horizon; whereas the first shows that angle from the vertical. See LEVEL.

QUADRAT, or *to quadrat a gun*, is to see it duely placed in its carriage, and that the wheels be of an equal height.

QUARTER, in *war*, signifies the sparing of men's lives, and giving good treatment to a vanquished enemy. Hence, *to give quarter*, *to take quarter*, &c.

QUARTERS, at a *siege*, the encampment upon one of the most principal passages round a place besieged, to prevent relief and convoys.

Head QUARTERS, *of an army*, the place where the commander in chief has his quarters. The quarters of generals of horse are, if possible, in villages behind the right and left wings; and the generals of foot are often in the same place: but the commander in chief should be near the centre of the army.

QUARTERS *of refreshment*, the place or places where troops that have been much harrassed are put to recover themselves, during some part of the campaign.

QUARTER *of an assembly*, the place where the troops meet to march from in a body, and is the same as the place of rendezvous.

Intrenched QUARTERS, a place fortified with a ditch and parapet to secure a body of troops.

Winter QUARTERS, sometimes means the space of time included between leaving the camp and taking the field; but more properly, the places where the troops are quartered during the winter.

The first business, after the army is in *winter-quarters*, is to form the chain of troops to cover the quarters well: which is done either behind a river, under cover of a range of strong posts, or under the protection of fortified towns. Hussars are very useful on this service.

It should be observed, as an invariable maxim, in *winter-quarters*, that your regiments be disposed in brigades, to be always under the eye of a general officer; and, if possible, let the regiments be so distributed, as to be each under the command of its own chief.

QUARTER-*master*, is an officer, generally a lieutenant, whose principal business is to look after the quarters of the soldiers, their cloathing, bread, ammunition, firing, &c. Every regiment of

of foot, and artillery, has a quarter-master, and every troop of horse one, who are only warrant-officers, except in the Blues.

QUARTER-*master-general*, is a considerable officer in the army, and should be a man of great judgement and experience, and well skilled in geography: his duty is to mark the marches, and encampments of an army: he should know the country perfectly well, with its rivers, plains, marshes, woods, mountains, defiles, passages, &c. even to the smallest brook. Prior to a march he receives the orders and route from the commanding general, and appoints a place for the quarter-masters of the army to meet him next morning, with whom he marches to the next camp, where being come, and having viewed the ground, he marks out to the regimental quarter-masters the ground allowed each regiment for their camp: he chuses the head quarters, and appoints the villages for the generals of the army's quarters: he appoints a proper place for the encampment of the train of artillery: he conducts foraging parties, as likewise the troops to cover them against assaults, and has a share in regulating the winter quarters and cantonments.

QUARTER-*wheeling of a platoon, &c.* is turning the front where the flank was; which is done to the right, by the man on the right wing keeping his ground, and facing about while the left wing wheels. See WHEELING.

QUARTER-*staff*, an old military weapon, is made of strong and even wood, bigger and heavier than a pike: it is 6½ feet long between the verrils, that keep fast the two pikes of iron stuck into the ends of the staff.

QUARTER, in the *manage*, as to work from quarter to quarter, is to ride a horse three times in upon the first of the four lines of a square; then, changing your hand, to ride him three times upon the second; and so to the third and fourth; always changing hands, and observing the same order.

QUARTERING *troops*, is to provide them with good quarters.

QUEUE D'ARONDE, in *fortification*, an outwork which is narrower at the gorge than at the front or face, being so called from its resembling a swallow's tail. Of this kind are some single or double tenailles, and even some horn-works whose sides are not parallel. See SWALLOW'S TAIL, and FORTIFICATION.

QUICK-*match*, in *laboratory works*. See LABORATORY.

QUILTING *grape-shot*, in *gunnery*. See LABORATORY, and *To make* GRAPE-SHOT.

QUINTAL, the same as hundred weight.

QUOIL, in *gunnery*, denotes when a rope is laid round in a ring, one turn over another, for its being transported, or laid away.

QUOINS, in *gunnery*. See COINS.

R

RABINET, in *gunnery*, formerly a name given to a small sort of ordnance between a falconet and a base, about 1½ inches diameter in the bore, 5 feet 6 inches long, and 300 pounds in weight, loaded with 6 ounces of powder, carries a shot 1¼ inches diameter. See CANNON.

RAFTERS, in *military buildings*, are pieces of timber, which, standing by pairs on the reason or raising-piece, meet in an angle at the top, and form the roof of a building.

It is a rule in building, that no rafters should stand farther than 12 inches from one another: and as to their sizes or scantlings, it is provided by act of parliament, that principal rafters, from 12 feet 6 inches to 14 feet 6 inches long, be 5 inches broad at the top, and 8 at the bottom, and 6 inches thick: those from 14 feet 6 inches, to 18 feet 6 inches long, to be 9 inches broad at the foot, 7 inches at the top, and 7 inches thick: and those from 18 feet 6 inches, to 21 feet 6 inches, to be 10 inches broad at the foot, 8 at the top, and 8 thick. Single rafters, 8 feet in length, must have 4½ inches, and 3¾ in their square. Those of 9 feet long, must be 5, and 4 inches square.

RAFTS, in a *military sense*, a kind of frames or floats made by laying pieces of timber together, or across each other, to serve as bridges for troops to pass over rivers.

To RAISE *a* {*siege*. See SIEGE.
{*plan of a fortress*, is the measuring, with cords and geometrical instruments, the length of the lines, and the capacity of the angles,

angles, that by knowing the length, breadth, and thickneſs, of all the different parts of a fortification, it may be repreſented in ſmall upon paper, ſo as to know the advantages and diſadvantages of it.

RALLYING, in *war*, re-eſtabliſhing, or forming together again, troops broken and put to flight.

Battering-RAM, in *antiquity*, a military engine uſed to batter and beat down the walls of places beſieged.

The battering-ram was of two ſorts, the one rude and plain, the other compound. The former ſeems to have been no more than a great beam, which the ſoldiers bore on their arms and ſhoulders, and with one end of it, by main force, aſſailed the walls. The compound ram is thus deſcribed by Joſephus: it is a vaſt beam, like the maſt of a ſhip, ſtrengthened at one end with a head of iron, ſomething reſembling that of a ram, whence it took its name. This was hung by the middle with ropes to another beam, which lay acroſs two poſts, and hanging thus equally balanced, it was by a great number of men drawn backwards and puſhed forwards, ſtriking the wall with its iron head.

Plutarch informs us, that Mark Anthony, in the Parthian war, made uſe of a ram 80 feet long: and Vitruvius tells us, that they were ſometimes 106, and ſometimes 120 feet long; and to this perhaps the force and ſtrength of the engine was in a great meaſure owing. The ram at one time was managed by a whole century of ſoldiers; and they, being ſpent, were ſeconded by another century; ſo that it played continually, without any intermiſſion.

The momentum of a battering-ram 28 inches in diameter, 180 feet long, with a head of caſt-iron of one tun and a half, the whole ram, with its iron hoops, &c. weighing 41,112 pounds, and moving by the united ſtrength of 1000 men, will be only equal to that of a ball of 36 pounds, when ſhot point-blank from a cannon.

RAMMER, an inſtrument uſed for driving down ſtones or piles into the ground in military works; or for beating the earth, in order to render it more ſolid for a foundation.

Rammer *of a gun*, the ram-rod or gun-ſtick; a rod uſed in charging of a gun, to drive home the powder, as alſo the ſhot, and the wad, which keeps the ſhot from rolling out. The rammer of a piece of artillery, is a cylinder of wood, whoſe diameter and length are each equal to the diameter of the ſhot, with a handle fixed to it, at the end of which is another cylinder, covered with lamb-ſkin, ſo as to fit the gun exactly, and called a ſponge: it is uſed to clean the piece before and after it is fired.

RAMPART, in *fortification*, or, as ſome call it, but improperly, *rampire*; the great maſſy bank of earth raiſed about a place to reſiſt the enemy's great ſhot, and to cover the buildings. On it is raiſed a parapet towards the campain. It is not above 18 feet high, and about 60 or 70 thick, unleſs more earth be taken out of the ditch than can be otherwiſe beſtowed. The rampart ſhould be ſloped on both ſides, and be broad enough to allow the marching of waggons and cannon, beſides the parapet which is raiſed on it. The rampart of the half-moons is better for being low, that the ſmall-arms of the beſieged may the better reach the bottom of the ditch; but it muſt be ſo high, as not to be commanded by the covert-way. The rampart is encompaſſed with a ditch, and is ſometimes lined with a fauſſe-bray and a berme. During a ſiege, ſoldiers are always poſted on the rampart, and ſometimes artillery to ſtrengthen the defence.

RAMPS, in *fortification*, are ſloping communications, or ways of very gentle aſcent, leading from the inward area, or lower part of a work, to the rampart or higher part of it.

RAMS-*horns*, in *fortification*, are a kind of low works make in the ditch of a circular arc: they were invented by M. Belidor, and ſerve inſtead of tenailles.

RANDOM-*ſhot*, in *artillery*, when the piece is elevated at an angle of 45 degrees upon a level plane. See Range.

RANGE, in *gunnery*, the diſtance from the battery to the point where the ſhot or ſhell touches the ground.

Point-blank Range, that when the piece lies in a horizontal direction, and upon a level plane, without any elevation. See Point-Blank.

RANGING, in *war*, diſpoſing the troops in order proper for an engagement, for manœuvring, or for marching, &c.

RANK, is a ſtraight line made by the ſoldiers of a battalion, or ſquadron, drawn up ſide by ſide: this order was eſtabliſhed for the marches, and for regulating the different bodies of troops and officers which compoſe an army.

Rank, *and precedence in the army and navy*, as follows:

Engineers Rank. Chief, as colonel; director, as

as lieutenant-colonel; sub-director, as major; engineer in ordinary, as captain; engineer extraordinary, as captain-lieutenant; sub-engineer, as lieutenant; practitioner-engineer, as ensign.

Navy RANK. Admiral, or commander in chief of his Majesty's fleet, has the rank of a field-marshal; admirals, with their flags on the main-top-mast-head, rank with generals of horse and foot; vice-admirals, with lieutenant-generals; rear-admirals, as major-generals; commodores, with broad pendants, as brigadier-generals; captains of post-ships, after three years from the date of their first commission, as colonel; other captains, as commanding post-ships, as lieutenant-colonels; captains, not taking post, as majors; lieutenants, as captains.

RANK *between the army, navy, and governors.*

ARMY	NAVY	GOVERNORS
General in chief	Admiral in chief	Commander in chief of the forces in America
Generals of horse	Admiral with a flag at the main-top-mast	Captain-general of provinces
Lieutenant-generals	Vice-admirals	Lieutenant-generals of provinces
Major-generals	Rear-admirals	Lieutenant-governors and presidents
Colonels	Post-captains of 3 years	Lieutenant-governors not commanding
Lieutenant-colonels	Post-captains	Governors of charter colonies
Majors	Captains	Deputy governors
Captains	Lieutenants	Established by the king, 1760

Doubling of the RANKS, is the placing two ranks in one, frequently used in the manœuvres of a regiment.

RANKS *and files*, are the horizontal and vertical lines of soldiers when drawn up for service, &c.

RANSOM, in *military history*, a sum of money paid for the liberty of a prisoner of war; it also means the exchange of prisoners of war.

RAPIER, formerly signified a long, old-fashioned broad-sword, such as those worn by the Scotch regiments; but now is understood only to mean a small sword, as contradistinguished from a back-sword.

RASANT, } in *fortification*, rasant flank, or
RAZANT, } line, is that part of the curtain or flank whence the shot exploded rase or glance along the surface of the opposite bastion.

RATION, in the *army*, a day's allowance of bread, or of forage, given to every man and horse. A ration of bread is 1½ pound each day; and for a horse 20lb. of hay, 10lb. of oats, and 5lb. of straw, and for want of straw, 25lb. of hay. The officers have several rations, according to their rank. In the last German war, especially towards the latter end of it, a ration for a horse was only 18lb. of hay, 6lb. of oats, and 5lb. of straw.

It is to be observed, that the troops in North-America are daily supplied with ships provisions (independent of their pay) from his majesty's stores: a soldier's allowance per week is 7lb. of beef, or in lieu thereof 4lb. of pork; 7lb. of biscuit bread, or the same weight of flour; 6 oz. of butter; 3 pints of pease; ½lb. of rice: and this is called 7 rations. Of these rations a general had 12, colonel 6, lieutenant-colonel 5, major 4, captain 3, subaltern 2, staff 2, chief engineer 5, engineer in ordinary 3, practitioner engineer 2, director of the hospital 5, head surgeon 3, surgeon's mate 1, head apothecary 3, his mate 1, commissary of stores 3, his clerk 2.

RAVELINS, in *fortification*, are works raised on the counterscarp before the curtain of the place, and serve to cover the gates of a town, and the bridges. They consist of two faces, forming a saliant angle, and are defended by the faces of the neighbouring bastions. They are the most in use of all out-works, and are by the soldiers most commonly called half-moons. They should be lower than the works of the place, that they may be under the fire of

of the besieged. Their parapets, as those of all out-works, should be cannon-proof; that is, about 18 feet thick.

RAVINE, in *field fortification*, a deep hollow, usually formed by a great flood, or long-continued running of water; frequently turned to good purposes in the field.

REAR *of an army*, signifies, in general, the hindermost part of an army, battalion, regiment, or squadron; also the ground behind either.

REAR-*guard*, is that body of an army which marches after the main-body; for the march of an army is always composed of an advance-guard, a main-body, and a rear-guard; the first and last commanded by a general. The old grand-guards of the camp, always form the rear-guard of the army, and are to see that every thing come safe to the new camp. See GUARD.

REAR-*half-files*, are the three hindmost ranks of the battalion, when it is drawn up six deep.

REAR-*line*, of an army encamped, is always 1200 feet at least from the centre line; both of which run parallel to the front line, as also to the reserve.

REAR-*rank*, is the last rank of a battalion, when drawn up, and generally 16 or 18 feet from the centre-line, when drawn up in open order.

REBELLION, a traiterous taking-up of arms against the king by his own natural subjects, or those formerly subdued.

RECOIL, in *gunnery*, is the running-back of the artillery when fired; which is occasioned by the struggling of the powder in the chamber, and its seeking every way to fly out. Guns, whose vents are a little forward in the chase, recoil most. To lessen the recoil of a gun the platforms are generally made sloping towards the embrasures of the battery.

RECONNOITRE, in *military affairs*, implies to view and examine the state of things, in order to make a report thereof.

Parties ordered to reconnoitre, are to observe the country and the enemy; to remark the routes, conveniences and inconveniences of the first; the position, march, or forces of the second. In either case, they should have an expert geographer, capable of taking plans readily: he should be the best mounted of the whole, in case the enemy happen to scatter the escorte, that he may save his works and ideas.

All parties that go for reconnoitring only, should be but few in number. I would never chuse more than twelve or twenty men. An officer, be his rank what it will, cannot decline going with so few under his command: the honour is amply made up by the importance of the expedition, frequently of the most interesting consequence, and the properest to recommend the prudence, bravery, and address of any officer that has the fortune to succeed.

It is previously necessary that the officer ordered on this duty should be well accquainted with the country, the roads, and the distance of the enemy. His party must consist of men of approved fidelity, part of whom should be disguised. This detachment must march off in the night. The men must have strict orders neither to smoke tobacco, make a noise, nor speak. The officer must be provided with two guides, who are to be strictly interrogated, but are to remain ignorant of the route you intend to take. A detachment of this kind should be furnished with subsistence for 2 or 3 days. The horses are to be fed every 2 or 3 leagues, for it is absolutely necessary that they should be always fresh and fit for duty. The officer will take care never to halt, but at a distance from any road, and also take every precaution to prevent his being surprised, whilst his horses are feeding, &c.

RECRUITS, in *military affairs*, are new men raised to supply the places of such as have lost their lives in the service.

RECRUIT-*horses*, are the horses brought up for completing the regiments of horse and dragoons.

RECTANGLE. See ANGLE.

REDANS, in *field fortification*, are a kind of indented works, lines, or faces, forming sallying and re-entering angles, flanking one another; generally used on the sides of a river which runs through a garrison-town. They were used before bastions were invented, and are by some thought preferable to them.

REDENS, REDENT, } See REDANS.

REDOUT, in *fortification*, a square work of stone, raised without the glacis of the place, about musket-shot from the town; having loop-holes for the small arms to fire through, and surrounded by a ditch. Sometimes they are of earth, having only a defence in front, surrounded by a parapet and ditch. Both the one and the other serve for detached guards to interrupt the enemy's works; and are sometimes made on the angles of the trenches for covering the workmen against the sallies of the garrison. The length of their sides may be about

about 12 or 20 toises: their parapets must have 2 or 3 banquettes, and be about 9 or 10 feet thick. They are sometimes (in a siege) called places of arms.

REDOUT, is also the name of a small work made in a ravelin, of various forms. See FORTIFICATION.

REDOUT, *castle* or *donjon*, a place more particularly intrenched, and separated from the rest by a ditch. There is generally in each of them a high tower, from whence the country round the place may be discovered.

Detached REDOUT, is a work made at some distance from the covert-way, much in the same manner as a ravelin with flanks. See ARROW.

REDOUTS *en cremaillere*, differ from all the rest, because the inside line of the parapet is broken in such a manner as to resemble a pot-hook, or teeth of a saw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defilé, than if only a simple face was opposed to it, and consequently the passage is rendered more difficult. See Pl. XV. *fig.* 2.

REDOUBT, } See REDOUT.
REDUCT, }

REDUCE *a place*, is to oblige the governor to surrender it to the besiegers, by a capitulation.

RE-ENTERING *angle*, in *fortification*, is that which turns its point towards the centre of the place. See FORTIFICATION.

REFORM, in a *military sense*, is to reduce a corps of men, by either disbanding the whole, or only breaking a part, and retaining the rest; or sometimes by incorporating them with other regiments.

REFORMED-*officer*, is one whose troop or company is broke, and he continued in whole or half-pay, sometimes doing duty in the regiment: he preserves the right of seniority, and continues in the way of preferment.

REGIMENT, is a body of men, either horse, foot, or artillery, commanded by a colonel, lieutenant-colonel, and major: each regiment of foot is divided into companies, but the number of companies differ; though in England our regiments are generally 10 companies, one of which is always grenadiers, exclusive of the two independent companies. Regiments of horse are commonly 6 troops, but some of 9. Dragoon regiments, are generally in war-time 8 troops, and in time of peace but 6. Each regiment has a chaplain, quarter-master, adjutant, and surgeon. Some German regiments consist in 2000 foot, and the regiment of Picardy, in France, in 6000, being 120 companies, of 50 men in each company.

Regiments were first formed in France in the year 1558, and in England in the year 1660.

REGIMENTAL-*staff*. See STAFF.

REGIMENTALS, is the uniform cloathing of the army; and consists in a hat, coat, waistcoat, breeches, shirts, stocks, shoes, stockings, spats, spatterdashes, &c. See NECESSARIES.

REGULAR *attacks*, in a *siege*, are such as are made in form; that is, by regular approaches. See ATTACKS.

REINFORCE, in *founding guns*, that part of a gun next to the breech, which is made stronger to resist the force of the powder. There are generally two in each piece, called the first and second reinforce: the second is something smaller than the first, upon the supposition that when the powder is inflamed, and occupies a greater space, its force is diminished, which is a very great absurdity. See CANNON.

REINFORCE-*ring*. There are three in each gun, called the first, second, and third: they are flat mouldings, like flat iron hoops, placed at the breech end of the first and second reinforce, projecting the rest of the metal by about $\frac{1}{4}$ of an inch.

REINFORCEMENT *to the army*, is an addition of fresh troops to strengthen an army, in order to enable them to go on with an enterprise, &c.

REJOICING-*fire*, in *military affairs*, is used on obtaining a victory, or on celebrating some public festival. There are, however, two sorts of rejoicing fires; the one by a volley, and the other by a running fire from right to left of the battalion or line. When a volley is to be fired, the battalion or line is to fire together, either by a signal, or by word of command. But should a running fire be made, it is to be performed from right to left in the succession of files; that is, the men of the first file on the right of the battalion are, on the word of command, *Begin*, to pull their triggers; and then, as soon as those of the second file observe the flash in the pans of the first, they are also to pull their triggers; and so on from one file to another, 'till the fire ends with the left hand file of the battalion or line.

RELAIS. See BERM, and FORELAND.

RELAY-*horses*, in the *artillery*, are spare horses that march with the artillery and baggage, ready to relieve others, or to assist in getting up a hill, or through bad roads, &c.

RELIEVE *the guard*, is to put fresh men upon guard, which is generally every 24 hours.

To RELIEVE *the trenches*, is to relieve the guard of the trenches, by appointing those for that duty, who have been there before.

To RELIEVE *the sentries*, is to put fresh men upon that duty from the guard, which is generally done every two hours, by a corporal who attends the relief, to see the proper orders are delivered to the soldier who relieves.

RELIEVER, an iron ring fixed to a handle by means of a socket, so as to be at right angles to it: it serves to disengage the searcher of a gun, when one of its points is retained in a hole, and cannot be got out otherwise. See SEARCHER.

REMOUNT. To remount the cavalry or dragoons, is to furnish them with horses in the room of those which have been either killed or disabled.

RENCOUNTER, in the *military art*, an engagement of two little bodies or parties, detached from the army; in which sense it stands in opposition to a pitched battle.

RENDEZVOUS, RENDEVOUS, } in a *military sense*, the place appointed by the general, where all the troops that compose the army are to meet at the time appointed, in case of an alarm. This place should be fixed upon, according to the situation of the ground, and the sort of troops quartered in the village. In an open country it is easy to fix upon a place of rendezvous, because the general has whatever ground he thinks necessary. In towns and villages the largest streets, or market-places, are very fit: but let the place be where it will, the troops must assemble with ease, and proceed to the charge.

REPORTS, in *military matters*, are daily, weekly, and monthly reports, of the state of the companies or regiments, relative to their being absent, present, on duty, sick, confined, &c.

REPRISALS, a right which princes claim of taking from their enemies any thing equivalent to what they unjustly detain from them.

RESERVE, a body of troops sometimes drawn out of the army, and encamped by themselves, in a line behind the lines.

RESERVE-*guard*, the same as a picquet-guard, except that the one mounts at troop-beating, and the other at retreat-beating.

Body of RESERVE, *Corps of* RESERVE, } in *military affairs*, the third or last line of an army, drawn up in battle; so called, because they are reserved to sustain the rest, as occasion requires; and not to engage but in case of necessity.

RETIRADE, in *field fortification*, a trench with a parapet; but *retirade* and *coupture*, are commonly taken for a retrenchment formed by the two faces of the re-entering angle in a body of a place, after the first defence is ruined, and the besieged obliged to abandon the head of the work without quitting it entirely; therefore, while some are making head against the enemy, others should be busy in making the retirade; which is sometimes a simple barricade, or retrenchment, thrown up in haste, with a sort of ditch before it.

The *retirade* should be raised as high as possible, and some fougasses made under it, to blow up the enemy's lodgements.

RETREAT, in a *military sense*. An army or body of men are said to retreat when they turn their backs upon the enemy, or are retiring from the ground they occupied: hence, every march in withdrawing from the enemy is called a retreat.

That which is done in sight of an active enemy, who pursues with a superior force, makes my present subject; and is, with reason, looked upon as the glory of the profession. It is a manœuvre the most delicate, and the properest to display the prudence, genius, courage, and address, of an officer who commands: the histories of all ages testify it, and historians have never been so lavish of eulogiums as on the subject of the brilliant retreats of our heroes. If it is important, it is no less difficult to regulate, on account of the variety of circumstances, each of which demands different principles, and an almost endless detail. Hence a good retreat is esteemed, by experienced officers, the master-piece of a general. He should therefore be well acquainted with the situation of the country through which he intends to make it, and careful that nothing is omitted to make it safe and honourable.

RETREAT, is also a beat of the drum, at the firing of the evening-gun; at which the drum-major, with all the drums of the battalion, except such as are upon duty, beats from the camp-colours on the right to those on the left, on the parade of encampment: the drums of all the guards beat also; the trumpets at the same time sounding at the head of their respective troops. This is to warn the soldiers to forbear firing, and the sentinels to challenge 'till the break of day, that the reveille is beat. The retreat is likewise called setting the watch.

RETRENCHMENT, in the *art of war*, is any work raiſed to cover a poſt, and fortify it againſt an enemy; ſuch as faſcines loaded with earth, gabions, barrels, &c. filled with earth, ſand-bags, and generally all things that can cover the men, and ſtop the enemy: but it is more applicable to a ditch bordered with a parapet; and a poſt thus fortified, is called a *retrenched poſt*, or *ſtrong poſt*. *Retrenchments* are either general, or particular.

General RETRENCHMENTS, are a kind of new fortifications made in a place beſieged, to cover the defendents, when the enemy become maſters of a lodgement on the fortification, that they may be in a condition of diſputing the ground inch by inch, and of putting a ſtop to the enemy's progreſs in expectation of relief: as, if the beſiegers attack a tenaille of the place, which they judge the weakeſt, either by its being ill flanked, or commanded by ſome neighbouring ground; then the beſieged make a great *retrenchment*, incloſing all that part which they judge in moſt danger. Theſe ſhould be fortified with baſtions and demi-baſtions, ſurrounded by a good ditch countermined, and higher than the works of the place, that they may command the old works, and put the beſiegers to infinite trouble in covering themſelves.

Particular RETRENCHMENTS, ſuch as are made in the baſtions, when the enemy are maſters of the breach. They can never be made but in full baſtions; for in empty and hollow ones, *retirades* only can be formed. Theſe particular *retrenchments* are ſometimes made at firſt, which certainly is beſt. Count Pagan always made a double parapet in all his baſtions; and a *retrenchment* made before-hand requires no more men for its defence, than if it were not made; becauſe they never defend it 'till the principal work is loſt. The parapet of ſuch *retrenchment* ſhould be 6 or 8 feet thick, and 5 feet high, with a large and deep ditch, from whence ſhould run out ſmall *fougaſſes*; and alſo be countermined.

RETURNS, in a *military ſenſe*, are of various ſorts, but all tending to explain the ſtate of the army, regiment, or company; namely, how many capable of doing duty, on duty, ſick in quarters, barracks, infirmary, or hoſpital; priſoners, abſent with or without leave; total effective; wanting to complete to the eſtabliſhment, &c.

RETURNS *of a mine*, are the turnings and windings of the gallery leading to the mine. See GALLERY.

RETURNS *of a trench*, the various turnings and windings which form the lines of the trench, and are, as near as they can be, made parallel to the place attacked, to ſhun being enfiladed. Theſe *returns*, when followed, make a long way from the end of the trench to the head, which going the ſtraight way is very ſhort: but then the men are expoſed; yet, upon a ſally, the courageous never conſider the danger, but getting over the trench with ſuch as will follow them, take the ſhorteſt way to repulſe the enemy, and cut off their retreat, if poſſible.

REVEILLE, is the beat of a drum, about break of day, to advertiſe the army that it is day-light, and that the ſentinels forbear challenging.

REVERSE, in a *military ſenſe*, ſignifies *on the back*, or *behind*: ſo we ſay, *a reverſe commanding ground*, a *reverſe battery*, &c.

REVETEMENT, in *fortification*, a ſtrong wall, built on the outſide of the rampart and parapet, to ſupport the earth, and prevent its rolling into the ditch.

When the *revêtement* of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a ſquare ſtone at the top of it, projecting 6 inches, and a circular one below, or where the ſlope begins, of 8 or 10 inches diameter: they go quite round the rampart, and this circular projection is called the *cordon*.

REVIEW, is the drawing out all, or part of the army in line of battle, to be viewed by the king, or a general, that they may know the condition of the troops.

At all *reviews*, the officers ſhould be properly armed, ready in their exerciſe, ſalute well, in good time, and with a good air; their uniform genteel, &c. The men ſhould be clean and well dreſſed; their accoutrements well put on; very well ſized in their ranks; the ſerjeants expert in their duty, drummers perfect in their beatings, and the fifers play correct. The manual exerciſe muſt be performed in good time, and with life; and the men carry their arms well; march, wheel, and form with exactneſs. All manœuvres muſt be performed with the utmoſt regularity, both in quick and ſlow time. The firings are generally 36 rounds; viz. by companies; by grand diviſions; by ſub-diviſions; obliquely, advancing, retreating; by files; in the ſquare; ſtreet firings, advancing and retreating; and laſtly, a volley. The intention of a *review* is, to know the condition of the troops, to ſee that they are complete, and perform their exerciſe and evolutions well.

RHINELAND *rod*, is a meaſure of 12 feet, uſed by all the Dutch engineers.

RICOCHET, in *gunnery*, is when guns, howitzers or mortars, are loaded with ſmall charges, and elevated from 5 to 12 degrees, ſo as to fire over the parapet, and the ſhot or ſhell rolls along the oppoſite rampart: it is called *ricochet-firing*, and the batteries are likewiſe called *ricochet-batteries*. This [redacted]thod of firing was firſt invented by M. [redacted] and firſt uſed at the ſiege of Ath, in 1697. This method of firing out of mortars, was firſt tried in 1723, at the military ſchool at Straſbourg, and with ſucceſs. At the battle of Roſbach, in 1757, the king of Pruſſia had ſeveral 6-inch mortars made with trunnions, and mounted on travelling-carriages, which fired obliquely on the enemy's lines, and amongſt their horſe, loaded with 8 ounces of powder, and at an elevation of 1 degree 15 minutes, which did great execution; for the ſhells rolling along the lines, with burning fuzes, made the ſtouteſt of the enemy not wait for their burſting.

RIDEAU, in *military affairs*, is a riſing ground, or eminence, commanding a plain, ſometimes almoſt parallel to the works of a place: it is a great diſadvantage to have rideaus near a fortification, eſpecially when the enemy fire from far, and terminate on the counterſcarp: they not only command the place, but facilitate the enemy's approaches.

RIDER, in *artillery carriages*, a piece of wood ſomewhat higher than broad, the length equal to that of the body of the axle-tree, upon which the ſide-pieces reſt in a four-wheel carriage, ſuch as the ammunition-waggon, block-carriage, and ſling-waggons.

RINGS, in *artillery*, are of various uſes; ſuch as the laſhing-rings in travelling-carriages, to laſh the ſponge, rammer, and ladle, as well as the tarpauling that covers the guns; the rings faſtened to the breeching-bolts in ſhip-carriages; and the ſhaft-rings to faſten the harneſs of the ſhaft-horſe by means of a pin.

RIVETING-*plates*, in *gun-carriages*, ſmall ſquare thin pieces of iron, through which the ends of the bolts paſs, and riveted upon them.

ROCKETS. See Laboratory.

RODS, or *rammers*, either of iron or wood, to drive home the charges of muſkets, carabines, and piſtols.

Rods, or *ſticks*, faſtened to ſky-rockets, to make them riſe in a ſtraight line.

ROLL-*calling*, in *military matters*, is the calling over of a troop or company by their names, to ſee they are all preſent.

Muſter-Roll, is a return, which each captain gives the muſter-maſter, on which are written the names of both officers and ſoldiers of his company.

To Roll *in duty*, is when officers of the ſame rank take their turns upon duty, as captains with captains, ſubalterns with ſubalterns, and command according to the ſeniority of their commiſſions.

ROLLERS, are round pieces of wood of about 9 inches diameter, and 4 feet long, uſed in moving pieces of artillery from one place to another.

RONDEL, in *fortification*, a round tower, ſometimes erected at the foot of a baſtion.

ROPES, of various lengths and thickneſs, according to the uſes they are made for; ſuch as drays for the gin, for the ſling-cart and waggon, &c.

Drag-Ropes, in the *artillery*, by which the ſoldiers pull the guns backwards or forwards, both at practice and in an engagement, are of the following dimenſions, viz. For a 24-pounder, 54 feet long, with the loop-holes for the pegs included, and $5\frac{1}{4}$ inches in circumference; for 18 and 12-pounders, 48 feet long, and 4 inches in circumference; for 6 and 3-pounders, 39 feet long, and $1\frac{7}{8}$ inches in circumference. For 13 and 10-inch howitzers, 45 feet long, and $6\frac{1}{4}$ inches in circumference; for 8-inch howitzers, 48 feet long, and 4 inches in circumference; for all other howitzers, 35 feet long, and 2 inches in circumference.

ROSTER, in *military affairs*, is a plan or table, by which the duty of officers, entire battalions, and ſquadrons, is regulated.

ROUNDS, in *military matters*, a detachment from the main-guard, of an officer or a non-commiſſioned officer and 6 men, who go round the rampart of a garriſon, to liſten if any thing be ſtirring without the place, and to ſee that the ſentinels be diligent upon their duty, and all in order. In ſtrict garriſons the rounds go every half-hour. The ſentinels are to challenge at a diſtance, and to reſt their arms as the *round* paſſes. All guards turn out, challenge, exchange the parole, and reſt their arms, &c.

Rounds, are ordinary, and extraordinary. The ordinary rounds are three; the *town-major's round*, the *grand round*, and the *viſiting round*.

Manner of going the Rounds. When the town-major goes his *round*, he comes to the main-guard, and demands a ſerjeant and 4 or 6 men to eſcort him to the next guard; and when it is dark, one of the men is to carry a light.

As ſoon as the ſentry at the guard perceives the

the *round* coming, he shall give notice to the guard, that they may be ready to turn out when ordered; and when the *round* is advanced within about 20 or 30 paces of the guard, he is to challenge briskly; and when he his answered by the serjeant who attends the round, *Town-major's round*, he is to say, *Stand, round!* and rest his arms: after which he is to call out immediately, *Serjeant, turn out the guard! town-major's round.* Upon the sentry calling, the serjeant is to turn out the guard immediately, drawing up the men in good order with shouldered arms, the officer placing himself at the head of it, with his arms in his hand. He then orders the serjeant and 4 or 6 men to advance towards the *round*, and challenge: the serjeant of the *round* is to answer, *Town-major's round*; upon which the serjeant of the guard replies, *Advance, serjeant, with the parole!* at the same time ordering his men to rest their arms. The serjeant of the *round* advances alone, and gives the serjeant of the guard the parole in his ear, that none else may hear it; during which period, the serjeant of the guard holds the spear of his halbert at the other's breast. The serjeant of the *round* then returns to his post, whilst the serjeant of the guard, leaving his men to keep the *round* from advancing, gives the parole to his officer. This being found right, the officer orders his serjeant to return to his men; says, *Advance, town-major's round!* and orders the guard to rest their arms; upon which the serjeant of the guard orders his men to wheel back from the centre, and form a lane, through which the town-major is to pass (the escort remaining where they were) and go up to the officer and give him the parole, laying his mouth to his ear. The officer holds the spear of his esponton at the town-major's breast while he gives him the parole.

The design of *rounds* is not only to visit the guards, and keep the sentinels alert, but likewise to discover what passes in the outworks, and beyond them.

ROUTE, in *military matters*, an order to direct troops to march the road they are to take, and an authority to the magistrates to provide quarters for them.

ROYALS, in *artillery*, are a kind of small mortars, which carry a shell whose diameter is 5.5 inches. They are mounted on beds the same as other mortars. See *Dimensions of brass land-mortars*, at the word MORTAR.

ROYAL *academy*. See ACADEMY.

ROYAL *army*, an army marching with heavy cannon, capable of besieging a strong fortification, &c.

ROYAL *parapet*, in *fortification*, a bank about 3 toises broad, and 6 feet high, placed upon the brink of the rampart, towards the enemy: its use is to cover those who defend the rampart.

RUFFLE, } RUFF, } a beat on the drum. Lieutenant generals have 3 ruffles, major generals 2, brigadiers 1, and governors 1, as they pass by the regiment, guard, &c. See DRUM.

To RUN *the gantlope*, is a punishment for considerable offences. When a soldier is sentenced to run the gantlope, the regiment is drawn out in two ranks facing each other: each soldier, having a switch in his hand, lashes the criminal as he runs along naked from the waist upwards. While he runs, the drums beat at each end of the ranks. Sometimes he runs 3, 5, or 7 times, according to the nature of the offence. The major is on horseback, and takes care that each soldier does his duty

RUNNING-*fire*. See FIRE.

S

SABRE, in *military history*, a kind of sword, or scimetar, with a very broad and heavy blade, thick at the back, and a little falcated, or crooked towards the point.

SAC *à terre*. See BAGS.

SACKS. See BAGS.

SAFE-*guard*, in *military affairs*, a protection granted by a prince or general, for some of the enemy's lands, houses, persons, &c. to preserve them from being insulted or plundered. See GUARD.

SAKER, an old word for *cannon*. It carried a shot of 5 pounds and a quarter weight: the diameter of the bore was 3 inches and 9-16ths; the length 8 or 9 feet. See CANNON.

SALIENT *angle*, in *fortification*, that whose points turn from the centre of the place. See FORTIFICATION.

SALLY, in a *siege*, when a party of the garrison goes out privately, and falls suddenly on the besiegers in their trenches, endeavouring to drive them out, and destroy their works.

If the garrifon is weak, fallies are feldom made; though they fatigue an enemy, obftruct their works, &c. Prudence is the beft guide: they fhould be always bold, daring, fecret, and, at various times, equally concerted for the attack as for the defence.

SALTING-*boxes*, in *artillery*, are boxes of about 4 inches high, and 2½ in diameter, for holding mealed powder, to fprinkle the fuzes of fhells, that they may take fire from the blaft of the powder in the chamber; but it has been found that the fuze takes fire without this operation with mealed powder, which renders thefe *boxes* almoft ufelefs.

SALTPETRE, the principal ingredient for making gun-powder; it is found in great plenty in fome of the Eaft-India provinces, and in fome parts of Europe. See GUN-POWDER.

SALUTE, in *military matters*, a difcharge of artillery, or fmall arms, or both, in honour of fome perfon of extraordinary quality. The colours likewife falute royal perfons, and generals commanding in chief; which is done by lowering the point to the ground. In the field, when a regiment is to be reviewed by the king, or his general, the drums beat a march as he paffes along the line, and the officers falute one after another, bowing their half-pikes or fwords to the ground; then recover, and take off their hats. The enfigns falute all together, by lowering their colours.

SAND, in *military architecture*. The beft fand for good mortar, is that whofe grain is not too fmall, and muft be clear of the earthy particles. Sand found in rivers is efteemed the beft, as having a coarfe grain, and being free from earth and mud. See MORTAR.

SAND-*bags*, in *military affairs*. See BAGS.

SAP, in *fieges*, is a trench, or an approach made under cover of 10 or 12 feet broad, when the befiegers come near the place, and the fire from the garrifon grows fo dangerous, that they are not able to approach uncovered.

There are feveral forts of *faps*; the fingle, which has only a fingle parapet; the double, having one on each fide; and the flying, made with gabions, &c. In all *faps*, traverfes are left to cover the men.

SAPPERS, are foldiers belonging to the royal artillery, whofe bufinefs it is to work at the faps, and for which they have an extraordinary pay. A brigade of *fappers* generally confifts of 8 men, divided equally into two parties; and whilft one of thefe parties is advancing the fap, the other is furnifhing the gabions, fafcines, and other neceffary implements, who relieve each other alternately.

SARRAZINE. See PORTCULLIS, and HERSE.

SASHES, are badges of diftinction, worn by the officers, either round the waift, or over the fhoulder. They are made of crimfon filk.

SAUCISSE, SAUCISSON, in *mining*, is a long pipe or bag, made of cloth well pitched, or fometimes of leather, of about 1½ inch diameter, filled with powder, going from the chamber of the mine to the entrance of the gallery. It is generally placed in a wooden pipe, called an *auget*, to prevent its growing damp. It ferves to give fire to mines, caffions, and bomb-chefts, &c.

SAUCISSON, is likewife a kind of fafcine, longer than the common ones: they ferve to raife batteries, and to repair breaches. They are alfo ufed in making epaulements, in ftopping paffages, and in making traverfes over a wet ditch, &c.

SCALADE, in *military affairs*, a furious attack upon a wall or rampart, contrary to form, and with no precaution; frequently carried on with ladders, to infult the wall by open force.

SCALE, in a *military fenfe*, a right line divided into equal parts, reprefenting miles, fathoms, paces, feet, inches, &c. ufed in making plans upon paper; giving each line its true length, &c.

SCALING-*ladders*. See LADDERS.

SCALPING, in *military hiftory*, a barbarous cuftom, in practice amongft the Indian warriors, of taking off the tops of the fcalps of the enemies fculls with their hair on. They preferve them as trophies of their victories, and are rewarded by their chiefs, according to the number they bring in.

SCARP, in *fortification*, is the interior talus or flope of the ditch next the place, at the foot of the rampart.

SCENOGRAPHY, which is alfo called *profile* or *view*, is the natural reprefentation of a place, fuch as it appears to us, when we look upon it from without, confidering its fituation, the form of its walls, the number and figure of its fteeples, and the tops of its public and private buildings.

SCONCE, in *fortification*, a kind of fmall field-fort, built for the defence of fome pafs, or other poft.

SCOUR, or *to fcour a line*, is to flank it, fo as to fee directly along it, that a mufket-ball, entering at one end, may fly to the other, leaving no place of fecurity.

SCOUTS, in a *military fenfe*, are generally horfemen fent out before, and on the wings of an army, at the diftance of a mile or two, to difcover the enemy, and give the general an account of what they fee.

SCREWS, in *gunnery*, are faſtened to the caſcable of light guns and howitzers, by means of an iron bolt, which goes through a ſocket fixed upon the centre tranſom, to lay the piece with, inſtead of wedges; as is done in heavy pieces.

SEA-*mortars*. See Mortars.

SECOND *covert-way*, that beyond the ſecond ditch. See Fortification.

Second *ditch*, that made on the outſide of the glacis, when the ground is low, and water plenty. See Fortification.

Second *captain*. See Captain.

Second *lieutenant*. See Lieutenant.

SECTION, in *fortification*, is the ſame with its profile; or a delineation of its heights and depths raiſed on a plane, as if the works were cut aſunder to diſcover its inſide.

SENIORITY, in *military matters*, is the difference of time betwixt the raiſing of two regiments, whereby the one is ſaid to be ſo much ſenior to the other. All regiments take place according to ſeniority. The difference of time betwixt the dates of two commiſſions, makes the one ſenior to the other; and all officers of the ſame rank, roll by the ſeniority of their commiſſions.

SENTINEL, } is a private ſoldier, placed in
SENTRY, } ſome poſt, to watch the approach of the enemy, to prevent ſurpriſes, to ſtop ſuch as would paſs without order, or diſcovering who they are. They are placed before the arms of all guards, at the tents and doors of general officers, colonels of regiments, &c.

Sentinel *perdu*, a ſoldier poſted near an enemy, in ſome very dangerous poſt, where he is in hazard of being loſt.

SERGEANT, } in *war*, is a non-commiſ-
SERJEANT, } ſioned or inferior officer in a company of foot, or troop of dragoons, armed with a halberd, and appointed to ſee diſcipline obſerved; to teach the private men their exerciſe; and to order, ſtraiten, and form ranks, files, &c. He receives the orders from the adjutant, which he communicates to his officers. Each company has generally two ſerjeants.

Serjeant-*major*. See Major.

SETTERS, in *gunnery*, a round ſtick to drive fuzes, or any other compoſitions, into caſes made of paper.

SHAFT-*rings*. See Rings.

SHAFTS *of a carriage*, are two poles joined together with croſs-bars, whereby the hind horſe guides the carriage, and ſuports the fore part of the ſhafts, the hind part turning round an iron bolt.

Shaft-*bars*, are two pieces of wood to faſten the hind ends of the ſhafts together, into which they are pinned with wooden pins.

SHELLS, in *gunnery*, are hollow iron balls to throw out of mortars or howitzers, with a fuze-hole of about an inch diameter, to load them with powder, and to receive the fuze: the bottom, or part oppoſite the fuze, is made heavier than the reſt, that the fuze may fall uppermoſt; but in ſmall elevations it is not always the caſe, nor is it neceſſary; for, let it fall as it will, the fuze ſets fire to the powder within, which burſts the ſhell, and cauſes great devaſtation. The ſhells had much better be made of an equal thickneſs, for then they burſt into more pieces.

Meſſage-Shells, are nothing more than howitz ſhells, in the inſide of which a letter, or other papers, are put; the fuze-hole is ſtopt up with wood or cork, and the ſhells are fired out of a royal or howitz, either into a garriſon or camp. It is ſuppoſed that the perſon to whom the letter is ſent, knows the time, and accordingly appoints a guard to look out for its arrival.

Experiments with loaded Shells, *in 1761, Pruſſia.*

Nature of mortars	Powder in the chamber		Weight of the mortar			Strokes to drive fuze	Weight of ſhell fixed		Weight of powd. the ſhell cont.		Quantity of powder uſed		Fuze bur.	Elevation		Remarks
inch.	lb.	oz.	c.	qr.	lb.	N°.	lb.	oz.	lb.	oz.	lb.	oz.	"	"	'	Pieces the ſhell broke in
13	4	8	24	2	1	21	194		9	4½	8		16	30	30	18 pieces
	3						192½				7	8	19	45		26 do.
10	3	5	10	2	11	18	90		4	8	3	8	12	35	15	13 do.
	2						89	5			3	12	14	38	30	23 do.
Roy.		10		2	18	12	16		1	2	1		10	28	30	8 do.
		12				12	15	12				14	13	40		19 do.
Coeh.		5		2	28	10	8	4		8		7	12	30		6 do.
		5				10	8	5		8		6	14	38	30	12 do.

Weight of land-service SHELLS, *and powder to fill them, as also the quantity of powder to burst them into the greatest number of pieces.*

Nature	Highest	Medium	Lowest	Powder to fill them	Pow. to burst them in most pieces
	C. Q. lb.	C. Q. lb.	C. Q. lb.	lb. oz.	lb. oz
13 inch	1 3 1	1 2 27	1 2 22	9 4½	7 8
10 inch	0 3 9	0 3 5	0 3 1	4 14⅔	3 4
8 inch	0 1 20	0 1 18	0 1 16	2 3½	2 0
5⅗ inch	0 0 15	0 0 14½	0 0 14	1 1½	0 14
4⅖ inch	0 0 8	0 0 7½	0 0 7	0 8	0 7

The above experiments, in 1760, with loaded shells, were the mediums of 6 ranges, and will be of great use to the unexperienced artillerist; as the best quantity of powder to make shells burst in the most pieces, is not mentioned by any author I know.

SKINS. *Sheep-skins* are made use of to cover the mortars or howitzers between firing, to prevent any wet or dampness getting into them.

SHOOTING. See GUNNERY, and PROJECTILE.

SHOULDER *of a bastion.* See FORTIFICATION.

SHOULDER-*belt*, so called because it hangs over the shoulder, to carry the trooper or dragoon's sword: it is made of strong buff leather.

SHOT, a denomination given to all kinds of balls used for artillery and fire-arms; those for cannon being of iron, and those for guns and pistols, &c. of lead.

Grape, *Chain*, *Case* } SHOT. See LABORATORY.

Weight and number of SHOT, *&c. for* TIN CASES, *for land and sea service.*

Pounders	Land service: Weight of shot	Land service: Number of shot	Sea service: Weight of shot	Sea service: Number of shot	Weight of the Land service case		Weight of the Sea service case		Length of the Land service case	Length of the Sea service case	Wooden bottom: Length	Wooden bottom: Weight		Depth of the Groove in the wooden bottom
	oz.	N°.	oz.	N°.	oz.	dr.	oz.	dr.	inch.	inch.	inch.	lb.	oz.	inch.
42	6	94	13½	47	15	8			8¾		7/8	5	2	1¼
32	6	72	8	56	15				8¼		5 6/10	4		1
24	4	85	8	42	13	8			8		5	2		1
18	4	62	6	42	9	8			7¾		4½	1	5	1
12	2	84	4	42	7	8			6¼		3½	1	1	7/8
9	2	63	3	44	5	8			6		3		13	6/10 or ½
6	1½	56	2	40	4	4			4 9/10		3		8½	6/10
4			2	28			3	8	4 3/10		2 6/10		6¼	5/10
3	1¼	34	1½	31	2	4			3 9/10		2 4/10		4¼	5/10
1½	1	7			1	14			3 5/10		1 9/10		2¼	5/10
8 H	6	81			14				6 1/10		5	4		1
5½ H	3	55			8	8			4 1/10		4	1	8	8/10
4⅖ H	2	54			6	8			4 1/10		3½	1		7/10

N. B. H stands for howitzer.

SIDE-*pieces*, of *gun-carriages*. See CARRIAGES.

SIDE-*ſtraps*, in a *field-carriage*, are flat iron bands which go round the ſide-pieces, in thoſe places where the wood is cut acroſs the grain, to ſtrengthen them near the centre and the trail.

SIEGE, in the *art of war*, is to ſurround a fortified place with an army, and approach it by paſſages made in the ground, ſo as to be covered againſt the fire of the place. See Pl. XV.

The firſt operation of a *ſiege* is inveſting: the body of troops inveſting a town ſhould, at leaſt, be as ſtrong again as the garriſon: they divide themſelves into ſeveral parties, in order to take poſſeſſion of all the avenues leading to the place. By day they ſhould keep themſelves out of cannon-ſhot; but as ſoon as it is duſk, they muſt approach much nearer, the better to be able to ſupport each other, and to ſtraiten the town.

General phraſes and terms uſed at a SIEGE *are, viz.*

To beſiege a place. See SIEGE.

To accelerate the SIEGE, is when an army can approach ſo near the place as the covert-way, without breaking ground, under favour of ſome hollow roads, riſing grounds, or cavities, and there begin their work.

An attack, is when the beſieging army can approach the town ſo near as to take it, without making any conſiderable works.

To form a SIEGE, there muſt be an army ſufficient to furniſh 5 or 6 reliefs for the trenches, pioneers, guards, convoys, eſcorts, &c. an artillery, with all the apparatus thereto belonging; magazines furniſhed with a ſufficient quantity of all kinds of warlike ſtores; and an infirmary with phyſicians, ſurgeons, medicines, &c.

To raiſe a SIEGE, is to give over the attack of a place, quit the works thrown up againſt it, and the poſts formed about it. If there be no reaſon to fear a ſally from the place, the *ſiege* may be raiſed in the day-time. The artillery and ammunition muſt have a ſtrong rear-guard, leſt the beſieged ſhould attempt to charge the rear: if there be any fear of an enemy in front, this order muſt be altered diſcretionally, as ſafety and the nature of the country will admit.

To turn a SIEGE *into a blockade*, is to give over the attack, and endeavour to take it by famine; for which purpoſe all the avenues, gates, and ſtreams, leading into the place, are ſo well guarded, that no ſuccour can get to its relief.

To inſult a work, is a ſudden unexpected attack, with ſmall arms, or ſword in hand.

Surpriſe, is the taking a place by ſtratagem or treaſon.

To eſcalade a place, is to approach it ſecretly, then to place ladders againſt the wall, or rampart, for the troops to mount and get into it that way.

To petard a place, is privately to approach the gate and fix a petard to it, ſo as to break it open for the troops to enter.

Line of circumvallation, is a kind of fortification, conſiſting of a parapet, or breaſt-work, and a ditch before it, to cover the beſiegers againſt any attempt of the enemy in the field.

Line of countervallation, is a breaſt work, with a ditch before it, as the line of circumvallation, to cover the beſiegers againſt any ſally from the garriſon.

Lines, are works made to cover an enemy, ſo as to command a part of the country, with a breaſt-work and a ditch before it.

Retrenchment, a work made round the camp of an enemy, to cover it againſt any ſurpriſe.

An epaulement, is a breaſt-work of 8 or 10 feet high, to cover the cavalry. The breaſt-work of a battery is alſo called an epaulement.

Approaches, in a SIEGE, are works or trenches which the beſieging army make in the ground, in order to approach and make themſelves maſters of a fortified town, with as little loſs as poſſible.

Counter-approaches, are lines or trenches carried on by the beſieged, in attempting to attack the lines of the beſiegers in form, or to prevent approaches as much as poſſible.

Line of counter-approaches, a trench which the beſieged make from the covert-way to the right and left of the beſiegers attacks, in order to ſcour their works. This line muſt be perfectly enfiladed from the covert-way and the half-moon, &c. that it may be of no ſervice to the enemy, in caſe he gets poſſeſſion of it.

Batteries at a *ſiege*, cannot be erected 'till the trench is advanced within reach of the cannon of the place; that is, within what is generally underſtood to be a point-blank range, which is reckoned about 300 toiſes, or 1800 feet.

Cannon is made uſe of at a *ſiege* for two different purpoſes; the firſt, to drive away the enemy from their defences; and the ſecond, to diſmount their guns. To produce theſe two effects,

effects, the batteries should not be above the mean reach of cannon-shot from the place: therefore there is no possibility of constructing them, 'till the first parallel is formed; and as the distance of the first parallel from the second is generally 300 toises, the batteries must be on this line, or beyond it, nearer the town.

The construction of batteries belongs to the officers of the royal artillery, who generally consult with the engineer that has the direction of the siege, as well about their situation as about the number of their guns and mortars. They must be parallel to the works of the town which they are to batter. It is customary to place the mortar-batteries and gun-batteries side by side, and in the same line, to the end that they may batter the same parts. The use of both, as already observed, is to demolish the enemy's works, to dismount their guns, to penetrate into their powder magazines, and to drive the besieged from their works and defences; as also to ruin and destroy the principal buildings, by setting fire to the town; and to fatigue and distress the inhabitants in such a manner, that they shall press the garrison to surrender.

Biovack, is an extraordinary guard performed every night during a siege, to prevent any succours from entering the town.

To bombard, is to throw shells into a besieged place, in order to burn and destroy it, and by that means make the besieged capitulate the sooner.

Breach, is an opening made in the wall or rampart of a fortification, with cannon or mines, sufficiently wide for a body of men to enter the works, and drive the besieged out of it.

Camp, in a *siege*, is ranged all along the circumvallation, and within about 120 toises of it: the army fronts the circumvallation; that is, the troops have the line before and the town behind them.

Caissons, are small cases or chests, 2 or 3 feet long, and 1½ foot broad, which are filled with powder, and sometimes with loaded shells: they are set fire to by means of a saucisson, in the same manner as mines; when buried under the glacis, are productive of a very good effect. They should never be placed nearer than 6 or 8 feet to the inside of the covert-way, lest they should damage the troops that defend this post.

Capitulation, the conditions on which a place that is besieged surrenders, being articles agreed on between the besieged and besiegers. The most honourable and ordinary terms of capitulation are, for the garrison to march out at the breach with arms and baggage, drums beating, colours flying, matches lighted, with some pieces of artillery, waggons, and convoys for their baggage, and for the sick and wounded, &c.

Caponier, a kind of double covert-way, made at the bottom of a dry ditch opposite the curtains, to communicate with the outworks. It also denotes a work or lodgement on the glacis of a place, sunk 4 or 5 feet into the ground, with a parapet on each side, made with the earth thrown out of it, rising about 2 feet above the ground, on which planks are laid, well covered with earth.

Cavalier of the trenches, is an elevation which the besiegers make by means of gabions, within half way or 2-3ds of the glacis, to discover or to enfilade the covert-way. When this work (first invented by Mr. Vauban) is once finished, it is very difficult for the enemy to remain any where in the covert-way; as they would be too much exposed to the troops placed on the cavaliers.

Chamade, is when a town besieged wants to capitulate, or to make some proposals to the besiegers. In that case one or more drums mount the rampart, and beat what the military call a *chamade*.

Chandeliers, are a kind of frames fit for holding a quantity of fascines, in order to cover the workmen from the enemy's fire at a siege. They are made of two pieces of timber, raised perpendicularly on two other horizontal pieces, upon which they are supported on both sides by braces. The space between the two vertical pieces is filled with fascines.

Chevaux-de-frize, are large joists or beams of timber, about 5 or 6 inches square, and 10 or 12 feet long, through which pass a number of wooden pins about 6 feet long, and 1½ inch diameter, shod with iron. They are made use of to stop up narrow passages, breaches, &c. during a siege.

Circumvallation, a work made of earth, consisting of a parapet and a ditch, with which towns are surrounded when besieged. Very seldom used now.

To clear, is said of those who make a sally, when they fill up the trench and beat off the enemy.

Countervallation, is a fortification made of earth like that of the circumvallation, the intent of which is to secure the troops employed in the *siege* against any insult from the garrison.

The

The besieging army is between the circumvallation and the countervallation. The first fronts the county, and the second the town. Almost out of use at present.

Epaulement, is the parapet of a battery of cannon or mortars at a siege. This name is also given to elevations of earth, which are sometimes made in the lines, to cover the cavalry from the fire of the place. In a siege, *épaulements* are generally made 9 or 10 feet high, near the entrance of the approaches.

Escalade, is the attack of a place by surprise, and getting over the walls or rampart by the assistance of ladders.

Fascines, are a kind of faggots made of small branches of trees, or brush-wood, tied in 4 or 5 places; they are made from 2 to 10 feet long, and about 1 or 1¼ feet diameter. Frequently used in sieges.

Pitched fascines, are such as are daubed over with pitch and tar, in order to destroy the enemy's works.

Front attack, that part of a fortification, against which the besiegers make their approaches, and point their artillery.

Blinds, are wooden frames of 4 pieces, round or flat, two of which are 6 feet long, and pointed at the ends, and the others 3 or 4 feet, which serve as spars to fasten the two first together. Their use is to fix them upright against the sides of the saps, to sustain the earth, and to fasten the fascines on the upper part, or to cover the sap, and to lay fascines over them, to secure the troops from stones and grenades.

Gabions, are a kind of baskets without a bottom, every where equally wide, 5 or 6 feet high, and about 3 in diameter, having 9 or 10 stakes of about 1½ inch in diameter; which exceed the basket-work 5 or 6 inches, and are pointed, so as to stick into the ground. They are generally made by the miners and sappers.

Stuft gabions, are large gabions filled with different things, to prevent their being perforated by musket-shot: the sappers roll them before them, to cover themselves against the fire of the place.

Herissons, are large beams or trees, of the length of a breach made in a fortification, stuck thick with iron spikes, and rolled down upon the breach, to hinder the besiegers from mounting: they are sometimes made to slide with rollers.

Insulting a work, is to make a sudden and open attack upon it.

Investing a place, is to surround it with troops on all sides, so that the town shall receive no succours of men or provisions. This is properly the first operation of a siege. The body of troops investing a town should at least be as strong again as the garrison: they are to divide themselves into several parties, the better to take possession of all the avenues leading to the place. By day they should keep themselves out of the reach of cannon-shot; but as soon as it is dark, they must approach much nearer, the better to be able to support each other, and to straiten the town.

The *investing* is generally made by cavalry; but when the country is cut with ravins, or hollow ways, or when there are woods in the neighbourhood of the place, then there must be likewise a body of infantry to guard all the avenues, and even to stop up, by a kind of retrenchments, such as might be the easiest to penetrate.

A few days after the *investing*, the besieging army arrives, and is disposed of round the town by the engineer, who directs the siege, and the lines are opened, &c.

Line of circumvallation. See CIRCUMVALLATION.

Line of countervallation. See COUNTERVALLATION.

Line of counter-approach. See APPROACH.

Lodgement, is a kind of retrenchment made openly in some part of a work, from whence the enemy have been driven, in order to maintain that post, and to be covered from the fire of the neighbouring works. It is always made by the besiegers in some part of a fortification, after the besieged have been driven out.

Opening of the trenches, is when the workmen begin to dig them, at the first commencement of a siege.

Parallels, or *places of arms*, are a part of the trenches, which surround the whole front attacked, and serve to hold the soldiers, who are to protect and support the workmen: they are about 8 or 10 feet deep, and 16 or 18 feet wide.

Park, in *artillery*, is the place where all the ammunition and magazines are secured for an army carrying on a siege. It must be in some part most remote from the town, and the least exposed to be insulted, but on the same side where the attack is to be made: it is generally made in the form of a square redout, with a breast-work and a ditch round it, and the entrance covered with a redan, or small ravelin.

Pickets, are a kind of stakes, sharp at one end, to hold the fascines together in making saps, lodgements, and filling up of ditches, &c.

in a siege. They are 3 feet long, and about 1½ inch diameter.

Place of arms, in the operations of a siege, is what we generally call the parallels. They are the parts of a trench opposite to the front attacked.

Place of arms, in a dry ditch, is a kind of covert-way made at the extremity of the faces to defend the ditch at a siege.

Quarter, at a *siege*, is a part of the army, consisting of one or more brigades, and generally under the command of a general officer. It likewise implies the incampment of the besiegers.

Sally, at a *siege*, is when a body of troops go privately out of a besieged town, fall suddenly upon the besiegers, and destroy part of their works, nail their cannon, and do every other damage they can.

Sand-bags, are made about 2 feet high, and 8 or 10 inches diameter: they are filled with earth, and cover the workmen in making their approaches. They are sometimes placed on the ramparts, three together, for the troops to fire through.

Saps, in a *siege*, are trenches made under cover from the fire of the place, behind a mantlet or stuft gabion: they are generally 10 or 12 feet broad. This work differs from the trenches, in as much as the latter are made uncovered. The sap has also less breadth; but when it is as wide as the trench, it bears the same name. There are various sorts of saps, viz.

Single sap, is that which is made on one side only, or, which is the same thing, has only one parapet.

Double sap, has a parapet on each side, and is carried on wherever its two sides are seen from the place.

Flying sap, is that in which the besiegers do not give themselves the trouble of filling the gabions with earth: it is made where the workmen are not much exposed, and in order to accelerate the approaches.

Sap-faggots, are a kind of fascines, but only 3 feet long, and about 6 inches in diameter.

Saucissons, are another species of fascines, from 12 to 19 feet long, and from 8 to 10 inches in diameter, and are used in making batteries, and repairing the breaches.

Sortie. See *Sally*.

Trail, or *rear of the trench*, is the first work the besiegers make when they open the trenches.

Tambour, is a kind of traverse, at the upper end of the trench or opening made in the glacis to communicate with the arrows. This work hinders the besiegers from being masters of the arrow, or discovering the inside of the place of arms belonging to the covert-way.

Traverses, in a *siege*, is a name given to a kind of retrenchment made in the dry ditch, to defend the passage over it.

Trenches, are a kind of passages or turnings dug in the earth, in order to approach a place without being seen from its defences.

To turn a work, is to cut off its communication with the place, endeavouring to take it by its gorge. A work is said to be turned when the besiegers get between that work and the place.

Wool-packs, used in a *siege*, differ from sand-bags, in this only, that they are much larger, and instead of earth they are filled with wool. They are used in making lodgements in places where there is but little earth, and for other similar purposes. They are about 5 feet high, and 15 inches diameter.

Rear of an attack, is the place where the attack begins.

Front, or head of an attack, that part next to the place.

Mantlets, are wooden fences, rolling upon wheels, of 2 feet diameter; the body of the axle-tree is about 4 or 5 inches square, and 4 or 5 feet long; to which is fixed a pole of 8 or 10 feet long, by two spars; upon the axle-tree is fixed a wooden parapet, 3 feet high, made of 3-inch planks, and 4 feet long, joined with dowel-pins, and two cross-bars: this parapet leans somewhat towards the pole, and is supported by a brace, one end of which is fixed to the pole, and the other to the upper part of the parapet. They are used to cover the sappers in front against musket-shot.

Crows-feet, or *Chausse-trap*, is a kind of iron, with 4 points, so disposed, as always to have 3 points downwards, and 1 upwards: they serve also to stop the horse.

Maxims in SIEGES are, 1st. The approaches should be made without being seen from the town, either directly, obliquely, or in the flank.

2. No more works should be made than are necessary for approaching the place without being seen; i. e. the besiegers should carry on their approaches the shortest way possible, consistent with being covered against the enemy's fire.

3. All the parts of the trenches should mutually support each other; and those which are farthest advanced, should be distant from those that defend them above 120 or 130 toises, that is, within musket-shot.

4. The

4. The parallels, or places of arms the moſt diſtant from the town, ſhould have a greater extent than thoſe which are the neareſt, that the beſiegers may be able to take the enemy in flank, ſhould they reſolve to attack the neareſt parallels.

5. The trench ſhould be opened or begun as near as poſſible to the place, without expoſing the troops too much, in order to accelerate and diminiſh the operations of the ſiege.

6. Care ſhould be taken to join the attacks; that is, they ſhould have communications, to the end that they may be able to ſupport each other.

7. Never to advance a work, unleſs it be well ſupported; and for this reaſon; in the interval between the 2d and 3d place of arms, the beſiegers ſhould make, on both ſides of the trenches, ſmaller places of arms, extending 40 or 50 toiſes in length, parallel to the others, and conſtructed in the ſame manner, which will ſerve to lodge the ſoldiers in, who are to protect the works deſigned to reach the 3d place of arms.

8. Obſerve to place the batteries of cannon in the continuation of the faces of the parts attacked, in order to ſilence their fire; and to the end that the approaches, being protected, may advance with great ſafety and expedition.

9. For this reaſon the beſiegers ſhall always embrace the whole front attacked, in order to have as much ſpace as is requiſite to place the batteries on the produced faces of the works attacked.

10. Do not begin the attack with works that lie cloſe to one another, or with rentrant angles, which would expoſe the attack to the croſs fire of the enemy.

Stores required for a month's Siege *are as follow:*

Powder, as the garriſon is more or leſs ſtrong		8 or 900,000 lb.
Shot	for battering pieces	6000
	of a leſſer ſort	20,000
Battering cannon		80
Cannons of a leſſer ſort		40
Small field-pieces for defending the lines		20
Mortars for throwing	ſhells	24
	ſtones	12
Shells for mortars		15 or 16,000
Hand grenades		40,000
Leaden bullets		180,000
Matches in braces		10,000
Flints for muſkets, beſt ſort		100,000
Platforms complete for guns		120 lb.
Platforms for mortars		60
Spare	carriages for guns	60
	mortar-beds	60
	ſpunges, rammers, and ladles, in ſets	20
Tools to work in trenches		40,000

Several hand-jacks, gins, ſling-carts, travelling forges, and other engines proper to raiſe and carry heavy burthens; ſpare timber, and all ſorts of miners tools, mantlets, ſtuffed gabions, faſcines, pickets, and gabions.

SIGNAL, in the *art of war*, a certain ſign agreed upon for the conveying intelligence, where the voice cannot reach. *Signals* are frequently given for the beginning of a battle, or an attack, uſually with drums and trumpets, and ſometimes with ſky-rockets, &c.

Signal-*flags*, in *ancient military hiſtory*, was a gilded ſhield hung out of the admiral's galley; it was ſometimes a red garment or banner, termed [illegible]. During the elevation of this the fight continues, and by its depreſſion or inclination towards the right or left, the reſt of the ſhips were directed how to attack their enemies, or retreat from them.

SILLON, in *fortification*, is a work raiſed in the middle of a ditch, to defend it when it is too wide. It has no particular form; ſometimes made with little baſtions, half-moons, and redans, which are lower than the works of the place, but higher than the covert-way. It is more frequently called *envelope*, which ſee.

SIMILAR *polygons*, are ſuch as have their angles ſeverally equal, and the ſides about thoſe angles proportional.

SIMITAR, in *war*, a crooked or falcated ſword, with a convex edge. Not in uſe now.

SIXAIN, in *ancient military hiſtory*, an order of battle, wherein ſix battalions being ranged in one line, the 2d and 5th are made to advance, and form the van-guard; the 1ſt and 6th to retire, and form the rear-guard; the 3d and 4th, remaining on the ſpot, to form the body of the battle.

SKIRMISH, in *war*, a diſorderly kind of combat, or encounter, in preſence of two armies, between ſmall parties who advance from the main body for that purpoſe, and introduce, or invite to, a general fight.

SLEEPERS, the undermoſt timber of a gun or mortar-battery. See Platform.

SLEETS, are the parts of a mortar going from the chamber to the trunnions, to ſtrengthen that part.

SLING-*cart*. See Carriage.

SOCIETY,

SOCIETY, in *general*, denotes a number of persons united together for their assistance in promoting the arts and sciences, security, interest, or entertainment.

SOLDIER, a military man listed to serve a prince or state, in consideration of a certain daily pay.

Soldiers are properly the land-forces of a kingdom, or state; but in England it is against the ancient law to keep an army of soldiers in time of peace. Where any soldier that is lawfully retained shall depart from his colours without leave, he is declared to be guilty of felony by 18 Hen. VI. c. 9. and every soldier, who either causes a mutiny, or deserts the service, shall be punished with death, or otherwise, as a court-martial shall think fit. All persons suspected of desertion are to be apprehended by constables, who shall be allowed a reward of twenty shillings for every such deserter.

By 4 Geo. I. c. 4. it is ordained, that no soldier shall be taken out of the service by any process in law, unless it be for some criminal matter, or where the debt he owes amounts to ten pounds at the least; of which affidavit is to be made, &c. Soldiers must be quartered in inns and ale-houses only, and not in private houses, without the consent of the owners, under certain penalties; and where victuallers refuse soldiers quartered on them, or constables receive any reward for excusing their neglect, they forfeit a sum not above fifty pounds, nor under thirty shillings, by 3 Geo. II. c. 2. A person inlisted for a soldier, within four days after, is to be carried before the next justice or chief magistrate of a town, and is to declare his assent that he listed voluntarily, &c.; but if he then dissents therefrom, on his returning the money received, and paying twenty shillings, he may be discharged. In case any subject of Great-Britain or Ireland shall list or enter himself, or procure any one to be inlisted a soldier to go beyond the seas, without leave obtained from his Majesty, such person shall be punished as a felon by 8 and 9 Geo. II. There are acts annually made for punishing mutiny, &c. of soldiers and false musters, and for the better payment of the army and their quarters.

SOLID *bastion*. See Fortification.

SOMMERS, in an *ammunition-waggon*, are the upper sides, supported by the staves entered into them with one of their ends, and the other into the side-pieces.

SORTIES, in a *siege*, parties that sally out of a town secretly to annoy the besiegers, and retard their operations.

SOUND. The experiments are numerous by which it has been found, that sound is audible to the distance of 50, 60, or 80 miles; but Dr. Hearne, physician to the king of Sweden, tells us, that at the bombardment of Holmia, in 1658, the sound was heard 30 Swedish miles, which make 180 of ours: and in the fight between England and Holland in 1672, the noise of the guns was heard even in Wales, which cannot be less than 200 miles.

The velocity of sound is 380 yards, or 1142 feet in a second of time, as found by very accurate experiments. Hence the following

Table of the progression of SOUND.

seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches	seconds	yards	feet	inches
1	380	2		4½	1731			8	3045	1		11½	4377	2		15	5710		
1¼	475	2	6	4¾	1808	1		8¼	3140	1	6	11¾	4472	2	6	15¼	5805		6
1½	571			5	1903	1		8½	3235	2		12	4568			15½	5900	1	
1¾	656		6	5¼	1998	1	6	8¾	3310	2	6	12¼	4663		6	15¾	5995	1	6
2	761	1		5½	2093	2		9	3426			12½	4758	1		16	6090	2	
2¼	856	1	6	5¾	2188	2	6	9¼	3521		6	12¾	4853	1	6	16¼	6185	2	6
2½	951	2		6	2284			9½	3616	1		13	4948			16½	6281		
2¾	1046	2	6	6¼	2379		6	9¾	371[illegible]	1	6	13¼	5043		6	16¾	6376		6
3	1142			6½	2474	1		10	3806	2		13½	5139			17	6471	1	
3¼	1239		6	6¾	2569	1	6	10¼	3901	2	6	13¾	5234		6	17¼	6566	1	6
3½	1332	1		7	2664	2		10½	3997			14	5392	1		17½	6661	2	
3¾	1427	1	6	7¼	2759	2	6	10¾	4052		6	14¼	5421	1	6	17¾	6756	2	6
4	1522	2		7½	2855			11	4187	1		14½	5469	2		18	6851		
4¼	1617	2	6	7¾	2950		6	11¼	4282	1	6	14¾	5574	2	6	18¼	6946		6

By this table we can easily measure the distance of the clouds producing thunder and lightening; for suppose, from the moment we observe the flash, to the moment we hear the stroke of thunder, we count four seconds; which find in the table; and opposite thereto, you will find 1522 yards, 2 feet, for the distance of the cloud. In like manner the distance of ships at sea, of batteries in a siege, &c. is known by firing of guns. *Example:* On seeing the flash of powder, count the seconds 'till you hear the report, which suppose 2¼, the number opposite thereto is 856 yards, 1 foot, and 6 inches, the distance of the gun from the place you stand at. The horizontal range of a shell may likewise be found in this table. *Example:* Square the number of seconds, multiply that product by $16\frac{1}{12}$, and divide by 3, which gives the number of yards of a horizontal projection at 45°: or, to avoid fractions, multiply the seconds by 193, and divide by 36, which gives the same answer. For $12 \times 12 = 144 \times 16\frac{1}{12} = \frac{2316}{3} = 772$: or $12 \times 12 = 144 \times 193 = \frac{27792}{36} = 771$ as before.

The exactness of measuring distances by sound, has been sufficiently proved, by measuring the same distances by trigonometry.

SOW, in *ancient military history*, a kind of covered shed, fixed on wheels, under which the besiegers filled up and passed the ditch, sapped or mined the wall, and sometimes worked a kind of ram. It had its name from its being used for rooting up the earth like a swine, or because the soldiers therein were like pigs under a sow.

SPATTERDASHES, a kind of covering for the legs of soldiers, made of coarse linen waxed over, and buttoned tight; by which the wet is kept off.

SPATTS, a small sort of spatterdashes, that reach only a little above the ancle, much worn by the royal artillery, and gentlemen cadets.

SPIES, in *war*, are persons employed to

give

give intelligence of what the enemy is doing. They ſhould be well paid: who pays them ill, is never well ſerved. They ſhould never be known to any body, nor ſhould they know one another. When they propoſe any thing very material, ſecure their perſons, or have their wives and children as hoſtages for their fidelity. If they are apprehended, they immediately ſuffer death.

SPIES are found in the cabinets of princes, in the cloſets of miniſters, amongſt the officers of the army, and in the councils of generals; in towns belonging to the enemy, and in monaſteries. The greateſt generals ſtrongly recommend them, whatever expence they may occaſion; and indeed a commander had better be in want of many particulars, however neceſſary, than be deſtitute of ſpies. Nothing ſhould be ſpared to procure them; and even the promiſes made to them ſhould be obſerved with the moſt inviolable integrity.

SPLICE. A rope is ſaid to be *ſpliced*, when the ſeveral ſtrands of each end, being untwiſted, are wrought into one another in a peculiar manner, known to all artillery-men.

SPIKES, in *gunnery*. See HAND-SPIKES.

SPIN, or *to ſpin hay*, is to twiſt it up in ropes, very hard, for an expedition; by which means it is leſs bulky, and leſs troubleſome for the cavalry to carry behind them. An expert horſeman can ſpin five days forage into a very narrow compaſs.

SPONTOON, is a weapon much like a halberd, now uſed inſtead of a half-pike by the officers of foot. When the ſpontoon is planted, the regiment halts; when pointed forwards, the regiment marches; and when pointed backwards, the regiment retreats.

SPONGE, in *gunnery*, is a cylinder of wood fixed to a handle, whoſe diameter and length are equal to the ſhot in guns, covered with a lamb-ſkin to clean the piece with, after it has been fired.

SPURS, in *old fortifications*, are walls that croſs a part of the rampart, and join to the town-wall.

SQUADRON, a body of cavalry, compoſed of three troops. The number is not fixed, but is generally from 80 to 120 men. The eldeſt troop always takes the right of the ſquadron, the ſecond the left, and the youngeſt the centre.

SQUADS, in a *military ſenſe*, are certain diviſions of a company into ſo many ſquads, generally into 3 or 4. The uſe of forming companies into as many ſquads of inſpection as it has ſerjeants and corporals, is proved by thoſe regiments who have practiſed that method; as by it the irregularity of the ſoldiers is conſiderably reſtrained, their dreſs improved, and the diſcipline of the regiment in general moſt remarkably forwarded. Every officer ſhould have a roll of his company by ſquads.

SQUARE *battalion of men*, is that which is compoſed of an equal number of men in rank and file. To make a ſquare battalion of men, whoſe number is known, as 50, take the neareſt ſquare root, which is 5, for the number of men in rank and file.

SQUARE *battalion of ground*, the number being likewiſe determined, as 60, that number muſt be multiplied by 3, the number of feet that each man takes in front, and the product, 180, divided by 7, the number of feet each man takes up in depth, or the diſtance of the ranks: the quotient is 25, the ſquare root of which is 5, the number of men in each file: by the root 5 you divide 60; the quotient is 12, the number of men in each rank.

Solid SQUARE, is a body of foot, where both ranks and files are equal. It was formerly held in great eſteem; but when the prince of Naſſau introduced the hollow ſquare, this was ſoon neglected. Both the ſolid and hollow ſquare are almoſt exploded from tactics.

Hollow SQUARE, is a body of foot drawn up with an empty ſpace in the centre, for the colours, drums and baggage, facing every way to charge the horſe.

STAFF, in *military matters*, conſiſts of a quarter-maſter-general, adjutant-general, and majors of brigade. The ſtaff properly exiſts only in time of war. See QUARTER-MASTER-GENERAL, &c.

Regimental STAFF, conſiſts in the adjutant, quarter-maſter, chaplain, and ſurgeon, &c.

STANDARD, in *war*, a ſort of banner or flag, borne as a ſignal for the joining together of the ſeveral troops belonging to the ſame body.

The ſtandard is uſually a piece of ſilk $1\frac{1}{2}$ feet ſquare, on which is embroidered the arms, device, or cypher, of the prince or colonel. It is fixed on a lance 8 or 9 feet long, and carried in the centre of the firſt rank of a ſquadron of horſe, by the cornet.

STAPLES, in *artillery carriages*, are driven into the ſide-pieces of gun and mortar carriages, to faſten the keys of the eye-bolts by means of chains: there are alſo ſtaples to the lockers of gun-carriages, &c.

STAR-*fort*, in *fortification*. See FORT, and FORTIFICATION.

STAVES, round and flat, uſed in ammunition

tion and other waggons or carts, are round and flat ſticks between the ſommers and ſide-pieces, alſo in common and ſcaling ladders.

STAYS, in *truck carriages*, are the irons which are fixed one end under the fore axle-tree, and the other to the ſide-pieces, in the form of an S.

STEGANOGRAPHY, the art of ſecret writing, or of writing in cyphers, known only to perſons correſponding, and much uſed in the army.

STOLE. See ORDER OF THE STOLE.

STONES, in *military architecture*, may be diſtinguiſhed into two ſorts; that is, into hard and ſoft: hard ſtone is that which is expoſed to the open air, ſuch as rocks, and which lies looſe upon the ſurface of the earth: the ſoft ſtone is that which is found in quarries, and under ground. It is undoubtedly true that the hardeſt ſtones make the moſt durable works; but as there is ſeldom a ſufficient quantity to build the whole fortification, the beſt ſerve in the facings of the work, in the foundations, and where the works are expoſed to the violence of the waves.

The ſtones of ſome quarries are very ſoft, and eaſily worked, when firſt taken out; but, when expoſed for ſome time to the open air, become very hard and durable.

As there is undoubtedly a kind of ſap in ſtones as well as in timber, by which the ſame ſort of ſtone, taken out of the ſame quarry, at one ſeaſon, will moulder away in a few winters, but, when dug out in another ſeaſon, will reſiſt the weather for many ages; ſtones ſhould always be dug up in the ſpring, that they may have time to dry before the cold weather comes in; for the heat of the ſun will extract the greateſt part of the moiſture, which otherwiſe expands in froſty weather, and cauſes the ſtone to ſplinter (as example teaches) although it is otherwiſe hard and good.

As ſtones lie in the quarries in horizontal beds or ſtrata, (that is, they cleave in that direction) and have likewiſe a breaking vein, which is perpendicular to the former; both theſe directions muſt be obſerved in cleaving, as well as raiſing them out of their beds. Stones that will not eaſily cleave muſt be blown up by gunpowder.

Marble, is of various ſorts and colours; the moſt beautiful of which is exported from abroad. The marble found in England is moſtly blackiſh, and ſo very hard and difficult to poliſh, that very little uſe is made of it, except to burn and make lime.

Fire-STONES, come from Reygate, and ſerve chiefly for chimneys, hearths, ovens, furnaces, and ſtoves; being a dry, porous, gritty ſtone, which bears the heat without breaking: on account of this quality, it is called *fire-ſtone*.

Purbeck-STONE, is a hard, greyiſh ſtone, and ſerves chiefly for paving, coping of walls, and for all ſuch other uſes where ſtrength is required, it being the moſt hard and durable ſtone, except the Plymouth marble. It is found on Purbeck iſland.

Rag-STONE, is of a bluiſh colour, and commonly uſed in paving: but there is a ſtone called *Kentiſh rag*, that is very uſeful in building; they ſplit very eaſily, and yet are very hard.

Free-STONE, more generally called *Portland-ſtone*: it is a fine whitiſh ſtone, without any veins. This ſtone is very ſoft when it comes out of the quarry, works very eaſily, and becomes very hard in time. Hence it is very fit for military works. It coſts about nine-pence a cubic foot upon the ſpot.

Alabaſter, is a clear whitiſh ſtone, not unlike coarſe marble. It is plentiful in ſome parts of Italy; but there is none to be found in England. It is to be had in great abundance in Scotland, and makes the very beſt of lime.

Whin, or *Aberde n whin*, is of a greyiſh colour, intermixed with veins, not unlike coarſe marble. This ſtone is the fitteſt of any for military works; becauſe it withſtands the weather, and the violence of the waves, better than any ſtone found in England.

STOPPAGES, in a *military ſenſe*, is a deduction of ſome part of a ſoldier's pay, the better to provide him with neceſſaries. A ſoldier ſhould never be put under a greater weekly ſtoppage from his pay, than what will afterwards leave him a ſufficiency for meſſing. Six-pence a week, beſides arrears, is as much as they can ſpare.

STORE-*keeper*, in *war-time*, muſt take care of the ſtores in the magazines, ſuch as the proviſions, forage, &c. receive the ſame from the contractors, and deliver them out to the troops. He has ſeveral clerks under him, appointed to the different departments, of proviſions, hay, ſtraw, oats, &c. In time of peace he has charge of all the king's ſtores, belonging both to land and ſea-ſervice.

STORM, in *military affairs*. See STRATAGEM.

STRATARITHMOMETRY, in *war*, the art of drawing up an army, or any part of it, in

any given geometrical figure; and of expressing the number of men contained in such a figure, as they stand in order of battle, either at hand, or at any distance assigned.

STRATAGEM, in *war*, any device for the deceiving and surprising an army, or any body of men. See SURPRISE.

STRAW. *For straw!* is a word of command to dismiss the soldiers when they have grounded their arms, so that they may be ready on the first signal given.

STREAKS, are the iron bands on the outside of the wheel to bind the fellies strongly together.

STREAK-*nails*, are those driven through the streaks into the fellies.

SUBALTERN. See OFFICER.

SUB-*brigadier*, an officer in the horse-guards, who ranks as cornet.

SUB-*lieutenant*, an officer in the royal regiment of artillery and fuzileers, where they have no ensigns; and is the same as second lieutenant.

SUBORDINATION, in *military matters*, consists in a perfect submission to the orders of superiors; in a perfect dependence, regulated by the rights and duties of every military man, from the soldier to the general. *Subordination* should show the spirit of the chief in all the members; and this single idea, which displays itself to the least attention, suffices to show its importance. Without *subordination* it is impossible that a corps can support itself; that its motions can be directed, order established, or the service carried on. In effect, it is *subordination* that gives a soul and harmony to the service; it adds strength to authority, and merit to obedience; it supports the staff of the marshal, as the sword of the soldier, which secures the efficacy of the command, and the honour of the execution: it is *subordination* which prevents every disorder, and procures every advantage to an army.

SUBSISTENCE, in the *military art*, is the money paid, weekly or monthly, to both officer and soldier, but not amounting to their full pay: the difference is called *arrears*. See PAY.

SUCCOUR, in *war*, the effort made to relieve a place; that is, to raise the siege, and force the enemy from it.

SULPHUR, or *brimstone*, a mineral, very useful in making gun-powder and artificial fire-works.

SURFACE, in *fortification*, is that part of the side which is terminated by the flank prolonged, and the angle of the nearest bastion: the double of this line with the curtain is equal to the exterior side.

SURPRISE, in *war*, to fall on an enemy unexpectedly, in marching through narrow and difficult passes, when one part has passed, so as not easily to come to the succour of the other; as in the passage of rivers, woods, enclosures, &c. A place is surprised by drains, case-mates, or the issues of rivers or canals; by encumbering the bridge or gate, by waggons meeting and stopping each other; sending soldiers into the place, under pretence of being deserters, who, on entering, *surprise* the guard, being sustained by troops in ambush near the place, to whom they give entrance, and seize it; soldiers sometimes dressed like peasants, merchants, Jews, priests, or women. The enemy sometimes send in their soldiers, as if they were yours coming from the hospital, &c. they also dress their soldiers in your regimentals, who, presenting themselves at your gate as such, are immediately admitted, seize the guard, and become masters of the place. Sometimes houses are set on fire, and whilst the garrison comes out to extinguish it, troops who lay in ambush march in, and surprise the place. Officers commanding guards at the principal gates are lured out under various pretences, so contrived as to seize the gate in coming in with them. Sometimes an alarm is given at one side of the garrison, whilst you enter secretly at the other, at that time too often neglected.

SURRENDER, in *war*, to lay down your arms, and surrender yourself prisoner; to give over a town, post, or other fortification, agreeably to articles, &c.

SURVEYOR *of the ordnance*. See ORDNANCE.

SUTLER, in *war*, one who follows the army, and furnishes provisions for the troops. They pitch their tents, or build their huts in the rear of each regiment, and about head quarters.

SWALLOWS-*tail*, in *fortification*, an outwork, differing from a single tenaille, as its sides are not parallel, like those of a tenaille; but if prolonged, would meet and form an angle on the middle of the curtain; and its head or front composed of faces, forming a re-entering angle. This work is extraordinarily well flanked, and defended by the works of the place, which discover all the length of its long sides, &c.

SWEEP-*bar*, of a waggon, is that which is fixed on the hind part of the fore-guide, and passes under the hind pole, which slides upon it.

SWING-

SWING-*tree*, of a waggon, the bar faſtened acroſs the fore-guide, to which the traces of the horſes are faſtened.

SWORD, an offenſive weapon worn on the left ſide, and ſerving either to cut or ſtab: its parts are the handle, guard, and blade; to which may be added the bow, ſcabbard, chape, and pummel.

***Broad*-Sword, an original weapon of Scot**land; it is ſometimes called a back-ſword, as having but one edge: it is baſket-handled, and 3 feet 2 inches long.

Sword-*belt*, generally made of leather, ſometimes of ſilk, and ſometimes of ſteel chains: it is worn about the waiſt, to carry the ſword in.

T

TABLES, in *military affairs*, a kind of regiſter to ſet down the dimenſions of carriages for guns, mortars, &c. alſo for the practice of artillery, charges of mines, &c. See Supplement.

TACKLES, are more particularly uſed for ſmall ropes running in pullies, the better to manage all kinds of ordnance. See Gin.

TACTICS, in the *art of war*, the art of diſciplining armies, and ranging them into forms proper for fighting and manœuvring, &c.

In the time of the Romans, the Gauls and other nations on the continent fought in the phalanx order. It is this order which ſtill prevails through all Europe, except that it is deficient in the advantages and utility which Polybius aſcribes to it, and is injured and diſgraced by defects unknown in the ancient phalanx.

In Turenne's days troops were ranged 8 deep both in France and Germany. Thirty years after, in the time of Puyſegur, the ranks were reduced to 5, in the laſt Flanders war to 4, and immediately after to 3.

This part of the progreſſion from 8 to 3, being known, we eaſily conceive how the files of the phalanx had been diminiſhed from 16 to 8, in the ages preceding Turenne. It is to be preſumed that this depth was conſidered as ſuperfluous, and it was judged neceſſary to curtail it, in order to extend the front. However, the motion is of very little conſequence; we are now reduced to 3 ranks: let us endeavour to find out what qualities of the phalanx have been preſerved, and what might have been added thereto.

To ſhew that we have preſerved the defects of the phalanx in Europe, I ſuppoſe 2 bodies of troops, one of 8,000 men, ranged as a phalanx, 15 deep; the other, a regiment of 3 battalions, conſiſting only of 1500 men, drawn up in 3 lines after the ſame manner. Thoſe two bodies ſhall be perfectly equal in extent of front, and ſhall differ in nothing but in the depth of their files: the inconveniences and defects, therefore, occaſioned by the length of the fronts, are equal in both troops, though their numbers are very different: hence it follows, that in Europe the eſſential defects of the phalanx are preſerved, and its advantages loſt.

Let the files of this body, of 8,000, be afterwards divided, and let it be reduced to 3 in depth; its front will then be found 5 times more extenſive, and its depth 5 times leſs: we may therefore conclude, that the defects of the phalanx are evidently multiplied in the tactics of Europe, at the expence of its advantages, which conſiſted in the depth of its files.

The progreſs of the artillery has contributed greatly to this revolution. As cannon multiplied, it was neceſſary to avoid its effects; and the only method of doing it, was doubtleſs to diminiſh the depth of the files.

TAIL *of the trenches*, is the poſt where the beſiegers begin to break ground, and cover themſelves from the fire of the place, in advancing the lines of approach. See Trenches.

TALUS, in *fortification*, a ſlope made to the works of a fortification, both on the outſide and inſide, to prevent the earth from rolling down.

Exterior TALUS, is the outside slope of a work towards the country, and should be as small as possible, that the enemy may not find it easy to be mounted, either by escalade or otherwise: but if the earth be not good, the talus must be large, that it may keep it up the better: then it is necessary to support the earth with a slight wall, called a *revêtement*.

Interior TALUS, the inside slope of a work next the town, which is much larger than that of the outside, and has, at the angles of the gorge, and sometimes in the middle of the curtain, ramps or sloping roads, to mount upon the terre-plein of the rampart. The interior talus of the parapet should be very small, that men may fire over it with more ease.

Superior TALUS *of the parapet*, is a slope on the top of the parapet, that allows of the soldiers defending the covert-way with small shot, which they could not do were it level.

TAMBOUR, in *fortification*, is a kind of work formed of pallisades, or pieces of wood, 10 feet long, and 6 inches thick, planted close together, and driven 2 or 3 feet into the ground; so that, when finished, it may have the appearance of a square redout cut in two. Loop-holes are made 6 feet from the ground, and 3 feet asunder, about 8 inches long, 2 inches wide within, and 6 without. Behind is a scaffold 2 feet high, for the soldiers to stand upon. They are frequently made in the place of arms of the covert-way, at the salient angles, in the gorges, half-moons, and ravelins, &c.

TAMPIONS, } are wooden cylinders to put
TOMPIONS, } into the mouth of the guns, howitzers, and mortars, in travelling, to prevent the dust or wet getting in. They are fastened round the muzzle of the guns, &c. by leather collars.

They are sometimes used to put into the chambers of mortars, over the powder, when the chamber is not full.

TAMPIONS, in *sea service artillery*, are the iron bottoms, to which the grape-shot are fixed; the dimensions of which are as follow, viz.

42-pounders		$6\frac{6}{10}$ inches diameter
32 ditto	-	6
24 ditto	-	$5\frac{4}{10}$
18 ditto	-	$4\frac{9}{10}$
12 ditto	-	$4\frac{3}{10}$
9 ditto	-	$3\frac{9}{10}$
6 ditto	-	$6\frac{3}{4}$
4 ditto	-	$2\frac{9}{10}$
$1\frac{1}{2}$ ditto	-	$2\frac{1}{10}$
$\frac{1}{2}$ ditto	-	$1\frac{4}{10}$

TARGET, a sort of shield, being originally made of leather, wrought out of the back of an ox's hide. They are [illegible] used by the Scotch.

TARGET, is also a mark for the artillery to fire at, in their practice.

TARPAULINGS, are made of strong canvass, thoroughly tarred, and cut into different sizes, according to their several uses in the field; such as to cover the powder-waggons, and tumbrels (carrying ammunition) from rain: each field-piece has likewise one to secure their ammunition-boxes.

TAP-TOO, } See DRUM.
TATT-TOO, }

TECHNICAL *terms*, are all terms of art, used in a military sense, &c.

TE DEUM, as far as it concerns *military matters*, is a holy hymn sung in thanksgiving for any victory obtained, and which is sometimes abused, by being sung by the vanquished enemy, to conceal their shame, &c.

TENABLE, in the *military art*, something that may be defended, kept, and held against assailants.

TENABLE, is little used, but with a negative. When a place is open on all sides, and its defences all beaten down, it is no longer tenable. When the enemy has gained such a height, this post is not tenable.

TENAILLES, in *fortification*, are low works made in the ditch before the curtains: there are three sorts, viz. the first are the faces of the bastions produced, till they meet, but much lower; the second have faces, flanks, and a curtain; and the third have only faces and flanks.

Single TENAILLE, is a work whose front is advanced towards the country, having two faces, forming a re-entering angle: its two long sides terminate on the counterscarp, opposite to the angle of the shoulder.

Double TENAILLE, is a work, whose front having 4 faces, forms 2 re-entering, and 3 salient angles: its long sides are likewise parallel, and terminate on the counterscarp, opposite to the angle of the shoulder. Both the single and double tenailles have this fault, viz. that they are not flanked or defended at the re-entering angle, because the height of the parapet hinders the soldiers from discovering before that angle. Therefore tenailles should only be made, when there is not room enough to make horn-works. The ramparts, parapets, ditches, covert-way, and glacis of tenailles, are the same with other out-works.

TENAILLE *of a place*, is what is comprehended between the points of two neighbouring bastions;

bastions; as the faces, flanks, and curtain. Hence it is said, the enemy attacked the whole tenaille of a place, when they make two attacks on the faces of the two bastions.

TENAILLONS, are works made on each side of the ravelin, much like the lunettes: they differ, in that one of the faces of a tenaillon is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

TENTS, in *war*, a pavillion or portable house. They are made of canvass, for officers and soldiers to lie under when in the field.

The sizes of the officers tents are not fixed; some regiments have them of one size, and some of another: a captain's tent and marquée is generally $10\frac{1}{2}$ feet broad, 14 deep, and 8 high: the subalterns are a foot less; the major's and lieutenant-colonel's, a foot larger; and the colonel's 2 feet larger.

The subalterns of foot lie two in a tent, and those of horse but one.

The tents of private men are $6\frac{1}{2}$ feet square and 5 feet high, and hold 5 soldiers each.

The tents for the horse are 7 feet broad and 9 feet deep: they hold likewise 5 men, and their horse accoutrements.

Bell-Tents, so called from their resemblance to a bell: they serve to shelter the fire-arms from rain.

To pitch the Tents, is to fix them up ready for habitation, by the assistance of a ridge-pole, two standards, and a quantity of tent-pins.

TERRASS. See Mortar.

TERRE *plein*, in *fortification*, the top platform, or horizontal surface of the rampart, whereon the cannon are placed, as well as the troops that defend the place: it is also the passage of the rounds.

TERTIATE, in *gunnery*, is to examine the thickness of the metal of a piece of artillery, in order to judge of its strength. This is usually done with a pair of calliper compasses.

TERTIATING *a piece of ordnance*, is to find whether it has its due thickness at the vent, trunnions, and neck; if the trunnions and neck are in their due order, and the chase straight, &c.

TESTUDO, in the *military art of the ancients*, was a kind of cover or screen, which the soldiers of each company made themselves of their bucklers, by holding them up over their heads, and standing close to each other. This expedient served to shelter them from darts, stones, &c. thrown upon them, especially those from above, when they went to the assault.

Testudo, was also a kind of large wooden tower, which moved on several wheels, and was covered with bullocks hides: it served to shelter the soldiers, when they approached the walls to mine them, or to batter them with rams.

TEUTONIC *order*. See Order.

THEORY, in *general*, denotes every doctrine which terminates in speculation alone, without considering the practical uses and application thereof. Military theory and practice joined are exceedingly useful.

THUNDERING-*legion*, was a legion in the Roman army, consisting of Christian soldiers; who, in the expedition of the emperor Marcus Aurelius against the Sarmatæ, Quadi, and Marcomanni, saved the whole army, then ready to perish of thirst, by procuring, by their prayers, a very plentiful shower thereon, and at the same time a furious storm of hail, mixed with lightening and thunderbolts, on the enemy.

This is the account commonly given by ecclesiastical historians, and the whole history is engraven in bass-relievos on the Antonine column.

TILTS. See Tournaments.

TIMBER, in *military architecture*, includes all kinds of felled and seasoned wood used in the several parts of building, &c.

Oak, of all the different kinds of timber known in Europe for building, is the best in all respects; because, when it is well seasoned and dry, it is very tough and hard: it does not split so easy as other timber, and bears a much greater weight than any other. When it is used under cover, it never perishes, no more than in water; on the contrary, the older it grows, the harder it becomes; and when it is exposed to the weather, it exceeds all other timber for durableness. English oak is the best, American the next, then Norway, and lastly German.

Elm, if felled between November and February, is all spine or heart, and no sap, and is of singular use in places where it is always wet or dry. It is very tough and pliable; it is easily worked, and does not easily split: it bears driving of bolts and nails into it better than any other wood; for which reason it is almost the only kind of wood used in artillery.

Beach, is likewise a very useful wood; it is very tough and white when young, and of great strength, but liable to warp very much when exposed to the weather, and to be worm-eaten when used within doors. It is frequently used for axle-trees, fellies, and all kind of wheel-wright work: but where it is kept constantly wet, and free from air, it will out-last oak.

Ash. Its use is almost universal, but it is rather scarce in most parts of Europe: it serves in buildings, or for any other uses where it is

 skreened

ſkreened from the weather: hand-ſpikes and oars are chiefly made of it; and indeed it is the only wood that is fit for this, or any other purpoſe, which requires the wood to be tough and pliable.

Fir, commonly known by the name of *deal*, is of late much uſed in building, eſpecially within doors. It wants but little ſeaſoning, and is much ſtronger while the reſinous particles are not exhauſted, than when it is very dry: it will laſt long under water; and indeed ſome ſay it never periſhes there.

Cheſnut-tree, eſpecially wild cheſnut, is by many eſteemed to be as good as oak, but is exceedingly rare.

There are many other kinds of wood, but not generally uſed in military works, conſequently not mentioned here.

Preſerving of Timber. When boards, &c. are dried, ſeaſoned, and fixed in their places, care is to be taken to defend and preſerve them; to which the ſmearing them with linſeed oil, tar, or the like oleaginous matter, contributes much.

The Dutch preſerve their gates, port-cullices, draw-bridges, ſluices, &c. by coating them over with a mixture of pitch and tar, whereon they ſtrew ſmall pieces of cockle and other ſhells, beaten almoſt to powder, and mixed with ſea-ſand, which incruſts and arms it wonderfully againſt aſſaults of wind and weather.

Seaſoning of Timber. As ſoon as felled, it ſhould be laid in ſome dry, airy place, but out of reach of too much wind or ſun, even which, in exceſs, will ſubject it to crack and fly. It is not to be ſet upright, but laid along, one tree upon another, only with ſome ſhort blocks between, to give it the better airing, and prevent it becoming mouldy, which will rot the ſurface and produce muſhrooms on it. Some perſons daub the trees all over with cow-dung, which occaſions their drying equally, and prevents their cracking, as they are otherwiſe very apt to do.

Some recommend the burying timber in the earth, as the beſt method of ſeaſoning it; and others have found it a fine preſervative to bury their timber under the wheat in their granaries; but this cannot be made a general practice. In Norway, they ſeaſon their deal planks, by laying them in ſalt water for 3 or 4 days, when new ſawed, and then drying them in the ſun: this is found a great advantage to them; but neither this, nor any thing elſe, can prevent their ſhrinking.

The ſeaſoning timber is the beſt way of all, for piles and other pieces that are to ſtand under the earth, or water. The Venetians firſt found out this method; and the way they do it is this: they put the piece to be ſeaſoned in a ſtrong and violent flame, turning it continually round by means of an engine, taking it out when it is every where covered with a black coaly cruſt: by this means the internal part of the wood is ſo hardened, that neither earth nor water can damage it for a long time after.

TIME, in *fencing*. There are three kinds of time, that of the ſword, that of the foot, and that of the whole body. All the times that are perceived out of their meaſure, are only to be conſidered as appeals, or feints, to deceive and amuſe the enemy.

Time, in manœuvring, is that neceſſary interval betwixt each motion in the manual exerciſe, as well as in every movement the army or any body of men make.

TIN *tubes*. See Tubes, and Laboratory.

TIRAILLEURS, in *the art of war*, are a kind of ſkirmiſhers, or markſmen, advanced in front to annoy the enemy, and draw off their attention; or they are left behind to amuſe and ſtop their progreſs in the purſuit.

TIRE, are great guns, ſhot, ſhells, &c. placed in a regular form. See Piles.

TOMPION. See Tampion.

TOISE, in *military menſuration*, is a French meaſure, containing 6 of their feet, or a fathom: a ſquare toiſe is 36 ſquare feet, and a cubical toiſe is 216 feet.

Theſe two meaſures correſpond in the diviſion of the feet; but theſe diviſions being unequal, it is neceſſary to obſerve, that the proportion of the yard, as fixed by the Royal Society at London, to the $\frac{1}{2}$ toiſe as fixed by the royal academy at Paris, is as 36 to 38.355.

TONGS, *of a waggon*, a piece of wood fixed between the middle of the hind ends of the ſhafts, mortiſed into the fore croſs-bar, and let into the hind croſs-bar.

TOOLS, uſed in *war*, are of many denominations and uſes, as laboratory tools, mining tools, artificers tools, &c. which words ſee.

TOPOGRAPHY, in *military hiſtory*, a deſcription or draught of ſome particular place, or ſmall tract of land, as that of a fortification, city, manor or tenement, garden, houſe, caſtle, fort, or the like; ſuch as engineers ſet out in their drawings, for the information of their prince or general.

TOURNAMENTS, or *Turnaments*, in *military antiquity*, a kind of martial ſport, or exerciſe, which the ancient cavaliers uſed to perform, to ſhow their bravery and addreſs.

Tournaments had their origin from the ancient gladiatory combats, and not from the uſage of the northerly people, as is commonly believed. In Cicero's time they were called by the Greek name *Anabatis*, becauſe their helmet, in a great meaſure, obſtructed their ſeeing.

TOWER *baſtions*, in *fortification*, are ſmall towers, made in the form of baſtions, by M. Vauban, in his ſecond and third method; with rooms or cellars underneath, to place men and guns in them.

Moveable TOWERS, in *ancient military hiſtory*, were three ſtory high, built with large beams. Each tower was placed on 4 wheels or trucks, and towards the town covered with boiled leather, to guard it from fire, and to reſiſt the darts: on each ſtory 100 archers were poſted. They were puſhed by the force of men to the city wall. From theſe the ſoldiers, placed in the different ſtages, made ſuch vigorous diſcharges, that none of the garriſon dared to ſhow themſelves on the rampart.

TOWN-*adjutant*, is an aſſiſtant to the town-major. See ADJUTANT.

TOWN-*major*, is an officer conſtantly employed about the governor or officer commanding a garriſon, &c. He iſſues their orders to the troops, and reads its common orders to freſh troops when they arrive. He commands according to the rank he had in the army; but if he never had any other commiſſion than that of town or fort-major, he is to command as youngeſt captain. See MAJOR.

TRAIL, in *gunnery*, is the end of a travelling-carriage, oppoſite to the wheels, and upon which the carriage ſlides, when unlimbered, or upon the battery. See CARRIAGE.

TRAIN, in *war*, the attendance of a prince, or general, upon many occaſions.

TRAIN, is alſo uſed for a line of gun-powder, laid to give fire to a quantity thereof, in order to do execution by blowing up earth, works, buildings, &c.

TRAIN *of artillery*, in a *general ſenſe*, means the regiment of artillery; it alſo includes the great guns, and other pieces of ordnance belonging to an army in the field. See ARTILLERY.

TRAIN-*bands*, or *trained-bands*, a name given to the militia of England.

TRANSOMS, in *artillery*, are pieces of wood which join the cheeks of gun-carriages: there is but one in a truck-carriage, placed under the trunnion-holes; and four in the wheel-carriages, the trail, the centre, the bed, and the breaſt-tranſoms. See CARRIAGE.

TRANSOM-*plates*, with hooks. There is one on each ſide of the ſide-pieces, againſt each end of the tranſom, the bed-tranſom excepted, faſtened by two tranſom-bolts. See IRON-WORK OF FIELD CARRIAGES.

TRANSOM-*bolt*, with bars. They ſerve to tie the ſide-pieces to the tranſoms. See IRON-WORK OF FIELD CARRIAGES.

TRAVELLING { *carriages*. See CARRIAGE.
forge. See FORGE. }

TRAVERSE, in *fortification*, is a parapet made croſs the covert-way, oppoſite to the ſalient angles of the works, and near the places of arms, to prevent enfilades. They are 18 feet thick, and as high as the ridge of the glacis. There are alſo traverſes made in the caponiers; but then they are called *tambours*.

TRAVERSES, are likewiſe made within other works, when there are many hills and riſing grounds which may ſee the inſide of theſe works. They are alſo made in the ſaps, &c. See FORTIFICATION.

To TRAVERSE *a gun or mortar*, is to bring her about to the right or left with hand-ſpikes, 'till ſhe is pointed exactly to the object.

TRAVERSING-*plates*, in *gun-carriages*, are two thin iron plates, nailed on the hind part of a truck carriage of guns, where the hand-ſpike is uſed to traverſe the gun. See CARRIAGE.

TREMOINS, a term for pieces of earth left ſtanding, as marks, in the ditches of a fortification they are emptying, to know exactly how many cubical fathoms, or feet of earth, have been carried away; and thereby the workmen are paid.

TRENCHES, in a *ſiege*, are ditches made by the beſiegers, that they may approach more ſecurely to the place attacked; whence they are alſo called *lines of approach*. The tail of the trench is the place where it was begun, and its head is the place where it ends.

The *trenches* are uſually opened or begun in the night-time; ſometimes within muſket-ſhot, and ſometimes within half or whole cannon-ſhot, of the place; generally about 800 toiſes. They are carried on in winding lines, nearly parallel to the works, ſo as not to be in view of the enemy, nor expoſed to the enemy's ſhot.

The workmen employed in the *tren*[illegible] are always ſupported by a number of troop[illegible]

fend them against the sallies of the besieged. The pioneers, and other workmen, sometimes work on their knees, and are usually covered with mantlets or saucissons; and the troops who support them lie flat on their faces, in order to avoid the enemy's shot. On the angles or sides of the trench, there are lodgements, or epaulements, in form of traverses, the better to hinder the sallies of the garrison, and to favour the advancement of the trenches, and to sustain the workmen.

The platforms for the batteries are made behind the trenches; the first at a good distance, to be used only against the sallies of the garrison. As the approaches advance, the batteries are brought nearer, to ruin the defences of the place, and dismount the artillery of the besieged. The breach batteries are made when the trenches are advanced near the covert-way.

If two attacks, there must be lines of communication, or boyaus, between the two, with places of arms at convenient distances. The trenches are 6 or 7 feet high with the parapet, which is 5 feet thick, with banquettes for the soldiers to mount upon.

Returns of a TRENCH, are the elbows and turnings, which form the lines of approach, and made, as near as can be, parallel to the place, to prevent their being enfiladed.

To mount the TRENCHES, is to mount guard in the trenches, which is generally done in the night.

To relieve the TRENCHES, is to relieve the guard of the trenches.

To scour the TRENCHES, is to make a vigorous sally upon the guard of the trenches, force them to give way, and quit their ground, drive away the workmen, break down the parapet, fill up the trench, and nail their cannon.

Counter-TRENCHES, are trenches made against the besiegers; which consequently have their parapet turned against the enemy's approaches, and are enfiladed from several parts of the place, on purpose to render them useless to the enemy, if they should chance to become masters of them; but they should not be enfiladed, or commanded by any height in the enemy's possession.

To open the TRENCHES, is the first breaking of ground by the besiegers, to carry on their approaches towards the place. See SIEGE.

TRIANGLE, in *geometry*, is a figure of three sides, and three angles, and either plane or spherical.

Plane TRIANGLE, is that contained under three right lines.

Right-angled TRIANGLE, is that which hath one right angle.

Obtuse-angled TRIANGLE, is such as hath one obtuse angle.

Acute-angled TRIANGLE, is that which hath all its angles acute.

Equilateral TRIANGLE, is that which hath all its sides equal to one another, as likewise its angles equal to 60 degrees each.

Isosceles TRIANGLE, is that which hath only two sides equal.

Scalenous TRIANGLE, is that which hath no two sides equal. In every triangle, the sum of all the three angles is equal to two right ones; and the external angle, made by any side produced, is equal to the sum of the internal and its opposite one.

In every triangle, as well plane as spherical, the sines of the sides are proportional to the sines of the opposite angles.

TRIARII, in the *Roman militia*, a kind of infantry, armed with a pike, a shield, a helmet, and a cuirass; thus called, because they made the third line of the battle.

TRIBUNE, an officer in the Roman army, who commanded in chief over a body of forces, particularly the division of a legion, much the same with our colonel, or the French *maître-de-camp*.

TRIUMPH, a solemnity practised by the ancient Romans, to do honour to a victorious general.

There were two sorts of *triumphs*, the greater and the lesser, particularly called *ovation*: of these, the *triumph* was by much the more splendid procession. None were capable of this honour but the dictator, consuls, and prætors; though there are examples to the contrary, as particularly in Pompey the Great, who had a *triumph* decreed him when he was only a Roman knight, and had not yet reached the senatorial age.

The *triumph* was the most pompous show among the ancients: authors usually attribute its invention to Bacchus, and tell us, that he first triumphed upon the conquest of the Indies; and yet this ceremony was only in use among the Romans. The Grecians had a custom which resembled the Roman *triumph*; for the conquerors used to make a procession through the middle of their city, crowned with garlands, repeating hymns and songs, and brandishing their spears: their captives were also led by them, and all their spoils exposed to public view. The order of a Roman *triumph* was chiefly thus: The senate having decreed the general a *triumph*, and appointed a day, they

went out of the city gate to meet the conqueror, and marched in order with him through the city. The cavalcade was led up by the muficians, who had crowns on their heads; and after them came feveral chariots with plans and maps of the cities and countries fubdued, done in relievo: they were followed by the fpoils taken from the enemy, their horfes, arms, gold, filver, machines, tents, &c. After thefe came the kings, princes, or generals fubdued, loaden with chains, and followed by mimics or buffoons, who exulted over their misfortunes. Next came the officers of the conquering troops, with crowns on their heads. Then appeared the triumphal chariot, in which was the conqueror richly clad in a purple robe, embroidered with gold, fetting forth his glorious atchievements. His bufkins were befet with pearl; and he wore a crown, which at firft was only laurel, but afterwards gold: one hand held a laurel-branch, the other a truncheon. At his feet were his children, or fometimes on the chariot-horfes. As the triumphal chariot paffed along, they ftrewed flowers before it. The mufic played in praife of the conqueror, amidft the loud acclamations of the people, crying, *To triumph!* The chariot was followed by the fenate, clad in white robes, and the fenate by fuch citizens as had been fet at liberty, or ranfomed. The proceffion was clofed by the facrifices, and their officers and utenfils, with a white ox led along for the chief victim. In the mean time all the temples were open, and altars loaded with offerings and incenfe; games and combats were celebrated in the public places, and rejoicings appeared every where.

TROOP *of horfe*, or *dragoons*, is a fmall body of about 50 or 60, commanded by a captain, captain-lieutenant, cornet, quarter-mafter, and 3 or 4 corporals, who are the loweft officers in a troop.

TROOPER, a private man in a troop of horfe.

Troop, a certain beat of the drum. See Drum.

TROPHY, among the ancients, a pile or heap of arms of a vanquifhed enemy, raifed by the conqueror in the moft eminent part of the field of battle.

The *trophies* were ufually dedicated to fome of the Gods, efpecially Jupiter. The name of the deity, to whom they were infcribed, was generally mentioned, as was that alfo of the conqueror. The fpoils were at firft hung upon the trunk of a tree; but inftead of trees, fucceeding ages erected pillars of ftone, or brafs, to continue the memory of their victories. To demolifh a *trophy* was looked upon as a facrilege, becaufe they were all confecrated to fome deity.

Trophy-*money*, denotes certain money annually raifed in the feveral counties of the kingdom, towards providing harnefs, and maintaining the militia.

TROUS-DE-LOUP, in *field fortification*, are round holes, about 6 feet deep, and pointed at the bottom, with a ftake placed in the middle. They are frequently dug round a redout, to obftruct the enemy's approach. They are circular at top, of about 4½ feet diameter.

TRUCE, in the *art of war*, denotes a fufpenfion of arms, or a ceffation of hoftilities, between two armies, in order to fettle articles of peace, bury the dead, or the like.

TRUCKS *of a fhip-carriage*, are wheels made of one piece of wood, from 12 to 19 inches diameter, and their thicknefs is always equal to the caliber of the gun.

The Trucks *of garrifon-carriages* are made of caft-iron.

Truck-*carriage*, goes upon 4 trucks of 24 inches diameter, has two flat fide-pieces, of 10 inches broad, and ferves to carry guns, ammunition-boxes, or any other weights, from the ftore-houfes to the water fide, or to any fmall diftance.

TRUMPET, made of brafs or filver, with a mouth-piece to take out and put in at pleafure. Each troop of cavalry has one.

The firft found of a trumpet before a march, is when the drums beat a *general*, at which the troopers boot, faddle, and get ready. When the *affembly* begins to beat, the trumpet founds *to horfe*; on which the troopers mount, and, at the third found, march. The trumpet likewife founds a charge in the day of battle, and the retreat at night, &c. The cords of the trumpets are of crimfon, mixed with the colours of the facings of the regiments. The king's own regiment of dragoons, and the royal Irifh, are permitted to continue their kettle-drums; to which they are to have banners of the fame dimenfions as thofe which are ordered for the regiments of horfe.

TRUNCHEON, in *military affairs*, a ftaff of command, borne by a general officer. It likewife implies a club, or cudgel.

TRUNCHEONEER, is one armed with a truncheon.

TRUNNIONS, in *guns*, two cylindric pieces of metal in a gun, mortar, or howitzer, which project

project the piece, and by which they are supported upon their carriages. See CANNON.

TRUNNION-*plates*, are two plates in travelling carriages, mortars, and howitzers, which cover the upper parts of the side-pieces, and go under the trunnions; its fore part ends with a flat rose. See CARRIAGE.

TRUSS *of forage*, is as much as a trooper can carry on his horse's crupper. See SPUN-HAY.

Dimensions of Tin TUBES *for all the different sorts of artillery.*

Natures	Length			Length			Diameters		
	Heavy	Mediums	Light	Sea mortars	Land mortars	Howitzers	Cap at top	Cap at bottom	Spindle
	inches	inches	inches	inches	inches	inches	inches	inches	inches
42 pdrs.	9.7						.9	.15	.2
32 ditto	9.7						.9	.15	.2
24 ditto	8.9	8.3	6.5				.9	.15	.2
18 ditto	8.						.9	.15	.2
12 ditto	7.3	7.3	5.7				.9	.15	.2
9 ditto	6.8	6.8					.9	.15	.2
6 & 4 ditto	6.5	5.7	4.7				.9	.15	.2
3 ditto	5.9		4.2				.9	.15	.2
$1\frac{1}{2}$ ditto	4.2						.9	.15	.2
13 in. S. M.				12.			1.2	.12	.2
10 in. S. M.				$7.7\frac{1}{2}$			1.	.13	.2
10 in. L. M.					5.7		1.	.13	.2
8 in. L. M.					4.7		.9	.15	.2
$5\frac{1}{2}$ royal cohorn					4.2		.8	.15	.2
$4\frac{2}{5}$ royal cohorn						6.5	.9	.15	.2
8 in. H.						5.7	.8	.15	.2
$5\frac{1}{2}$ in. H.						4.2	.8	.15	.2
$4\frac{2}{5}$ in. H.						3.6	.8	.15	.2

N. B. S. M. stands for *sea-service mortar*, L. M. for *land-service mortar*, and H. for *howitzer*.

TUGPINS,

TUGPINS, are the iron pins which paſs through the fore ends of the ſhafts of the army carts, to faſten the draught-chains for the fore-horſes.

TUMBRELS, are a kind of carriages with two wheels only: they are uſed to carry the pioneers, miners, and artificers tools: ſometimes they are uſed to carry the money of the army.

TURNAMENT, or *tournament*, a martial ſport, or exerciſe, which the ancient cavaliers uſed to perform to ſhow their bravery and addreſs. They were firſt inſtituted in the year 934; but they made not their appearance in England 'till the reign of king Stephen, anno 1138.

TURNPIKE, in the *military art*, a kind of beam, ſtuck full of ſpikes, to be placed in a defile, breach, or at the entrance of a camp, &c. to keep off an enemy.

V U

VALOUR, in the *army*, is a generous character, which, far from aſſuming brutality and violence, with-holds the fury of the ſoldier, protects helpleſs women, innocent infants, and white old-age. No thing which is incapable of reſiſtance can ever be the object whereon true valour may exerciſe its prowеſs. Courage is that grandeur of ſoul which prompts us to ſacrifice all perſonal advantages, and even the preſervation of our beings, to a love of doing our duty. The exerciſe of this determined courage in the profeſſion of arms is called *valour*. It is compoſed of bravery, reaſon, and force: by *bravery* we underſtand that lively ardour which fires us for the combat; *reaſon* points out to us the method of conducting it with juſtice and prudence; and *force* is neceſſary for the execution. It is bravery which animates the heart, reaſon ſprings from the ſoul, and force depends upon the body: without bravery we fear obſtacles, danger, and death; without reaſon courage would have no legitimate view; and without force it would be uſeleſs: theſe three qualities ſhould concur to form true military valour.

VAN, the front of an army.

VAN-*guard*, that part of the army which marches in the front. See GUARD.

VEDETTE, in *war*, a centinel on horſeback, with his horſe's head towards the place whence any danger is to be feared, and his carabine advanced, with the butt-end againſt his right thigh. When the enemy has encamped, there are vedettes poſted at all the avenues, and on all the riſing grounds, to watch for its ſecurity.

The *vedettes* to the out-poſts ſhould always be double, for the following reaſons: Firſt, that whenever they make any diſcovery, one may be detached to the commanding officer of the out-poſts; ſecondly, that they may keep each other watchful; and thirdly, that the vigilance of both may render it impoſſible for any thing to come near them without being ſeen. They ſhould be at no greater diſtance from their detachment, than 80 or 100 paces.

VELOCITY. See GUNNERY, MOTION, and PROJECTILES.

VENT, in *artillery*, or, as it is vulgarly called, the *touch-hole*, is the opening through which the fire is conveyed to the powder which compoſes the charge.

As the placing the *vents* in mortars, howitzers, and guns, in the beſt manner, is ſo very delicate a point, and about which both authors and practitioners differ, we will advance what the reſult of experiments has demonſtrated. The moſt common method is to place the *vent* about $\frac{1}{4}$ of an inch from the bottom of the chamber, or bore; though we have ſeen many $\frac{1}{2}$ an inch, and ſome an inch from the bottom. It has always been imagined, that if the *vent* was to come out in the middle of the charge, the powder would be inflamed in leſs time than in any other caſe, conſequently produce the greateſt range; becauſe, if a tube be filled with powder, and lighted in the centre, the powder would be burnt in half the time it would be if lighted at one end. This gave a grounded ſuppoſition, that the greater quantity of powder burnt before the ſhot or ſhell was ſenſibly moved from its place, the greater force it would receive. To determine this, the king of Pruſſia, in 1765, ordered, that a light 3-pounder ſhould be caſt with three ſhifting *vents*, one at the centre of the charge, one at the bottom, and the other at an equal diſtance from the bottom and centre one; ſo that when one was uſed, the others were effectually ſtopped. The gun weighed 2C. 1qr. 20lb. its length was 3 feet 3 inches, and the bottom of the bore quite flat. It was loaded each time with $\frac{1}{4}$ of the ſhot's weight; when it was found, that when the loweſt or bottom *vent* was uſed, the ſhot went fartheſt, and the ranges of the others diminiſhed in proportion as they were diſtant from the bottom.

 The

The piece was elevated to 1 degree 30 minutes. In 1766, the same monarch had three small mortars made of equal size and dimensions: their bores were 4.6 inches, and 73.5 inches long; one had a cylindric chamber of 1.6 inches diameter, and 3.7 inches long; the other a concave chamber, the entrance of which was 1 inch diameter; the third a conic chamber, whose greatest diameter was 2.7 inches, and the least 1.4. Each of these chambers held $7\frac{1}{2}$ ounces of powder; they had each two vents, one at the bottom of the chamber, and the other at the centre. Each mortar weighed about 89 pounds, and the shell, when filled, 7 pounds; and the following experiments were tried. The ranges are in feet.

Experiments to find the proper place for VENTS, *and the best figure for chambers; by order of his majesty the king of Prussia.*

Powd. Ounces	Elevat. °	Elevat. ′	Place of vents.	Conic cham.	Cyli. cham.	Conca. chamb.	Remarks
5	30		middle	1890	1936	2290	Com pow. Cool day
5	35	30	ditto	1974	1998	2374	ditto ditto
5	45		ditto	2892	3031	3176	ditto ditto
5	45		ditto	2746	3018	3158	ditto ditto
5	30		bottom	2218	2400	2563	ditto, warm & windy
5	35	30	ditto	2357	2590	2739	ditto ditto
5	45		ditto	2986	3147	3267	ditto ditto
5	45		ditto	2843	3139	3281	ditto ditto
$7\frac{1}{2}$	45		middle	3263	3521	3698	ditto, cool & calm
$7\frac{1}{2}$	45		ditto	3228	3524	3702	ditto ditto
$7\frac{1}{2}$	45		ditto	3196	3516	3708	ditto ditto
$7\frac{1}{2}$	43	30	ditto	3276	3602	3824	ditto, warm & calm
$7\frac{1}{2}$	43	30	ditto	3209	3598	3796	ditto ditto
$7\frac{1}{2}$	44		bottom	3198	3567	3818	ditto ditto
$7\frac{1}{2}$	44		ditto	3201	3603	3823	ditto ditto
$7\frac{1}{2}$	43		ditto	3186	3579	3784	ditto ditto
$7\frac{1}{2}$	43		ditto	3214	3547	3748	ditto ditto

N. B. By this table it appears, that the concave chamber produced the greatest ranges, and that the bottom of the chamber is the best place for *vents*, having in that place the greatest effect. Each range was the medium of 12 rounds.

VENT-*field*, is the part of a gun or howitz between the breech-mouldings and the astragal.

VENT-*astragal*, that part of a gun, or howitzer, which determines the vent-field.

VETERAN, in the *Roman militia*, a soldier who was grown old in the service, or who had made a certain number of campaigns, and on that account was intitled to certain benefits and privileges.

Twenty years service were sufficient to intitle a man to the benefit of a veteran. These privileges consisted in being absolved from the military oath, in being exempted from all the functions of a soldier, in enjoying a certain salary or appointment, &c.

VIBRATION. See PENDULUM.

VICTORY, the overthrow or defeat of an enemy, in war, combat, duel, or the like.

VICTUALS, *or regulations for victualling the royal regiment of artillery, and other troops on board of the transports; with the method of classing the men, women, and children, into messes.*

As soon as the troops are embarked, the quarter-master immediately divides them into messes, allowing 4 or 6 to each mess; that is, 1 man, 1 woman, and 3 children under 10 years of age, being equal to a mess of 4 men. Children at 10 years of age are accounted men or women.

When the messes are completed, and every one classed to their births, the quarter-master gives the steward of the transport a return of the number thereof; upon the receipt of which he immediately issues out bedding and utensils at the following rate.

To each birth, 1 flock bed, 1 bolster, 2 blankets, and 1 rug.

To each mess, 2 bowls, 4 spoons, 1 can, and 1 pudding-bag.—N. B. Three men are generally appointed to 1 birth.

The following table gives the daily allowance of provisions of each species per man.

Days	Biscuit lb.	Beef lb.	Pork lb.	Peas pints	Oatmeal pints	Butter oz.	Cheese oz.	Beer gal.	Vinegar pints
Sunday	1	0	1	$\frac{1}{2}$	0	0	0	1	0
Monday	1	0	0	0	1	2	4	1	0
Tuesday	1	2	0	0	0	0	0	1	0
Wednesd.	1	0	0	$\frac{1}{2}$	1	2	4	1	0
Thursday	1	0	1	$\frac{1}{2}$	0	0	0	1	0
Friday	1	0	0	$\frac{1}{2}$	1	2	4	1	0
Saturday	1	2	0	0	0	0	0	1	$\frac{1}{2}$

N. B. The weights are averdupois, and the pints Winchester measure.

When

When any alterations from the above take place, it is in the following manner: A pint of wine, half a pint of brandy, rum, or arrack, are equal to a gallon of beer; 4 pounds of flour, or 3 pounds of the fame, with a pound of fruit, raifins, or ½ a pound of currants, or ½ a pound of pickled beef fuet, are equal to 4 pounds of beef, or 2 pounds of pork with peas; ½ a pound of rice is equal to 1 pound of oatmeal; a pint of olive oil is equal to 1 pound of butter, or 2 pounds of Suffolk cheefe; and ⅔ of a pound of Chefhire cheefe, is equal to 1 pound of Suffolk cheefe. Beef provided for his majefty's fhips, is to be cut into 4-pound pieces, and the pork into 2-pound pieces; and no unufual pieces are to be put up, fuch as legs, bones, fhins of oxen, cheeks of hogs, ox-hearts, &c.

If it fhould happen that the pork runs fhort, the captain is to order the purfer to iffue 3 pounds of beef for 2 pounds of pork.

For the better prefervation of the men's health, it is ordered that one day in the week, there fhall be iffued out to them a proportion of flour and fuet in lieu of beef; alfo a proportion of canvafs for pudding-bags, after the rate of 1 ell to every 16 men.

In foreign voyages, there fhall only be fupplied 3 months butter and cheefe; the remainder of thofe fpecies to be made up in olive oil.

TABLE *of the allowance of provifions ferved out at the different forts, garrifons, and ports, in North-America, to his majefty's troops; they paying at the rate of 2½d. per day, or per ration.*

7 days in all fpecies				7 days in any one fpecies				1 day in any one fpecies			
Species	lb.	oz.	pints	Species	lb.	oz.	pts.	Species	lb.	oz.	pts.
Flour	7			Flour	21			Flour	3		
Frefh beef	7			Pork	9	3		Pork	1	5	
Butter		6		Butter	5	4		Butter		12	
Pork in lieu of beef	4			Peas			28	Peas			4
Peas			3	Rice			10½	Rice			1½
Rice			½								

N. B. The pork, butter, peas, and rice, are in lieu of the 7 lb. of beef.

VIEW *of a place*, to befiege it, is faid to be taken when the general, accompanied by an engineer, reconnoitres it; that is, rides round the place, obferving its fituation, with the nature of the country about it; as hills, valleys, rivers, marfhes, woods, hedges, &c. thence to judge of the moft convenient place for opening the trenches, and carrying on the approaches; to find out proper places for encamping the army, and for the park of artillery.

To VIEW. See *To* RECONNOITRE.

VOLLEY, is a military falute, made by the difcharging of a great number of fire-arms at the fame time.

VOLUNTEERS, perfons who, of their own accord, either for the fervice of their prince, or out of the efteem they have for their general, ferve in the army without being inlifted, to gain honour and preferment, by expofing themfelves in the fervice.

UHLANS, are Uckranian foldiers, chiefly Mahometans. In perfon, drefs, and manner of fighting, they refemble the Tartars, Calmucks, &c. They are armed with piftols, fabres, a lance 15 feet long, and fometimes ufe a bow and arrow inftead of a carbine.

UNDECAGON, is a regular polygon of 11 fides.

UNIFORM. See REGIMENTALS.

UTENSILS, in a *military fenfe*, are neceffaries due to every foldier, and to be furnifhed by his hoft, where he is in quarters, viz. bed, with fheets, a pot, a glafs or cup to drink out of, a difh, a place at the fire, and a candle. See BILLETING.

W

WAD, in *gunnery*, made of hay or ſtraw, and ſometimes of tow rolled up tight in a ball, ſerves to be put into a gun after the powder, and rammed home, to prevent the powder from being ſcattered, which would have no effect when unconfined.

WAD-*mill*, a hollow form of wood to make the wads of a proper ſize.

WAD-*hook*, a ſtrong iron ſcrew, like thoſe that ſerve for drawing corks, mounted upon a wooden handle, to draw out the wad, or any parts of cartridges, which often remain in guns, and when accumulated ſtop up the vent.

WADDING, hay or ſtraw, or any other forage, generally carried along with the guns to be made into wads.

WAGGON, in *the army*, is a four-wheel carriage, drawn by 4 horſes, and for ſundry uſes.

Ammunition-WAGGON, is for tranſporting all kinds of ſtores, as alſo to carry bread, it being lined round in the inſide with baſket-work.

WARNING-*piece*. See EVENING-GUN, at the word GUN.

WAR, a conteſt or difference between princes, ſtates, or large bodies of people, which, not being determinable by the ordinary meaſures of juſtice and equity, is referred to the deciſion of the ſword.

It is that important event for which all military education is deſigned to prepare the ſoldier. It is for this that in peace he receives the indulgence of a ſubſiſtence from ſociety; and for this he is gratefully bound to ſecure the repoſe of that ſociety from the outrage of barbarians, and to guard its poſſeſſions from the devaſtations of banditti.

Though it would be equally needleſs, as impoſſible, to ſhow how often this art of the ſoldier has accompliſhed the deſign of its inſtitution; we ſhall however diſtinguiſh thoſe wars which are remarkable for having obtained the bleſſings of peace to this kingdom ſince the

War with Scotland, 1068.

Peace with { ditto, 1113.
France, 1113. }

War with France, 1116.

Peace with { ditto, 1118.
Scotland, 1139. }

War with France, 1161.

Peace with ditto, 1186.

War again with France, with ſucceſs, 1194.

Peace with ditto, 1195.

Civil war { renewed, 1215.
ended, 1216.
with France, 1224.
ended, 1243.
1262.
ended, 1267.
with France, 1294.
with Scotland, 1296. }

Peace { with France, 1299.
with Scotland, 1323. }

War { again with Scotland, 1327.
ended, 1328.
again with Scotland, 1333.
with France, 1339. }

Peace with France, May 8, 1360.

War { with France, 1368.
civil, 1400.
with Scotland, 1400. }

Peace with France, May 31, 1420.

War { with France, 1422.
civil between York and Lancaſter, 1452. }

Peace with France, Oct. 1471.

War { civil, 1486.
with France, Oct. 6, 1492. }

Peace { with ditto, Nov. 3, 1492.
with Scotland, 1502. }

War { with France, Feb. 4, 1512.
with Scotland, 1513. }

Peace with France, Aug. 7, 1514.

War with { ditto, 1522.
Scotland, 1522. }

Peace with { France, 1527.
Scotland, 1542. }

War with Scotland, directly after.

Peace with France and Scotland, June 7, 1546.

War with { Scotland, 1547.
France, 1549. }

Peace with both, March 6, 1550.

War { civil, 1553.
with France, June 7, 1557.
with Scotland, 1557. }

Peace with { France, April 2, 1559.
Scotland, 1560. }

War / Peace } with France { 1562.
1564. }

War with { Scotland, 1570.
Spain, 1588. }

Peace with ditto, Aug. 18, 1604.

War with {Spain, 1624. / France, 1627.

Peace with Spain and France, April 14, 1629.

War {civil, 1642. / with the Dutch, 1651.

Peace with ditto, April 5, 1654.

War with Spain, 1655.

Peace with Spain, Sept. 10, 1660.

War with {France, Jan. 26, 1666. / Denmark, Oct. 19, 1666.

Peace with the French, Danes, and Dutch, Aug. 24, 1667.

Peace with Spain, Feb. 13, 1668.

War with the Algerines, Sept. 6, 1669.

Peace with ditto, Nov. 19, 1671.

War with the Dutch, March, 1672.

Peace with ditto, Feb. 28, 1674.

War with France, May 7, 1689.

Peace, general, Sept. 20, 1697.

War with France, May 4, 1702.

Peace of Utrecht, Mar. 13, 1713.

War with Spain, Dec. 1718.

Peace with ditto, 1721.

War with {Spain, 1739. / France, March 31, 1744.

Peace with France, &c. 1748.

War with {France, 1756. / Spain, Jan. 4, 1762.

Peace with France and Spain, Feb. 10, 1763.

There are five different kinds of war, each of which is to be conducted differently the one from the other, viz. the *offensive*; the *defensive*; that between *equal powers*; the *auxiliary*, which is carried on out of our own territories, to succour a prince, or ally, or to assist a weaker, whom a more powerful prince has attacked; and the *civil war*.

Offensive War, must be long meditated on in private, before it breaks out: when it does, the success will depend upon two essential points; that the plan be justly formed, and the enterprises conducted with order. It should be well and maturely considered and digested, and with the greatest secrecy, lest, however able the prince or his council may be, some of the precautions necessary to be taken may be discovered. These precautions are infinite both at home and abroad.

Abroad, they consist in alliances, and security not to be disturbed in the meditated expedition; foreign levies, and the buying up of warlike ammunition, as well to increase your own stores as to prevent the enemy getting it.

The precautions at home consist in providing for the security of our distant frontiers, levying new troops, or augmenting the old ones, with as little noise as possible; furnishing your magazines with ammunition; constructing carriages for artillery and provisions; buying up horses, which as much as possible should be done among your neighbours, both to prevent their furnishing the enemy, and to preserve your own for the cavalry and the particular equipages of the officers.

Defensive War, may be divided into three kinds. It is either a war sustained by a prince suddenly attacked by another, superior to him in troops, and in means; or a prince makes this sort of war by choice on one side of his frontiers, while he carries on an offensive war elsewhere; or it is a war become defensive by the loss of a battle.

A *defensive war* which a prince, attacked by a superior enemy, sustains, depends entirely on the capacity of his general. His particular application should be, to chuse advantageous camps, proper to stop the enemy, without however being obliged to fight them; to multiply small advantages; to hem in the enemy in their forages, and to oblige them to do it with great escorts; to attack their convoys; to render the passages of rivers or defiles as difficult to them as possible; to force them to keep together: if they want to attack a town, to throw in succours before it is invested: in short, in the beginning, his chief aim should be, to acquire the enemy's respect by his vigilance and activity, and by forcing him to be circumspect in his marches and manner of encampment, in order to gain time himself, and make the enemy lose it. An able general, carefully pursuing these maxims, will give courage to his soldiers, and to the inhabitants of the country: he gives time to his prince, to take proper precautions to resist the enemy who attacks him, and thus changes the nature of this war, always disagreeable for him who is reduced to it.

To conduct a *defensive war* requires more military judgement than that of an offensive one.

A War *betwixt equal powers*, is that in which the neighbouring princes take no part, so long as the belligerant powers obtain no great advantage the one over the other. This sort of war never should last long, if you want to reap any advantages from it. As to its rules, they are intirely conformable to those already given; but we may look on it as a certain maxim in

this sort of war, that the general the most active and penetrating will ever in the end prevail over him who possesses these qualities in a lesser degree; because, by his activity and penetration, he will multiply small advantages, 'till at last they procure him a decisive one. A general, continually attentive to procure himself small advantages, ever obtains his end, which is to ruin the enemy's army; in which case he changes the nature of the war, and makes it offensive, which should ever be the chief object of his prince.

Auxiliary WAR, is that in which a prince succours his neighbours, either in consequence of alliances or engagements entered into with them, or sometimes to prevent their falling under the power of an ambitious prince.

If it is in virtue of treaties, he observes them religiously, in furnishing the number of troops prescribed, and even offering to augment it, if required; or by making a diversion by attacking the common enemy, or his allies.

If it is to prevent a neighbouring prince from being crushed by a power, who after this conquest may become dangerous to yourself, there are several measures to be taken for your own particular interest. One of the chief is, to exact from those you succour, the possession of some place, in security, lest they make their peace without your knowledge, or to your prejudice.

The general therefore chosen for the command of this auxiliary corps, should have wisdom, penetration, and foresight; wisdom, to preserve a proper discipline in his corps, that the allied prince may have no cause to complain of him; foresight and penetration, to prevent his troops suffering for want of subsistence, or being exposed to the perils of war, but in proportion to their numbers with those of the allied prince; and, finally, that nothing shall pass without his knowledge, which may be prejudicial to his master.

Civil or intestine WAR, is that between subjects of the same realm, or between parties in the same state. In this sense, we say, the civil wars of the Romans destroyed the republic; the civil wars of Grenada ruined the power of the Moors in Spain; the civil wars in England, begun 1641, ended in the king's death.

Religious WAR, is war maintained in a state on account of religion, one of the parties refusing to tolerate the other.

Holy WAR, is that anciently maintained by leagues and croisades, for the recovery of the Holy Land.

Civil and Religious WARS, are ever unhappy for the states who sustain them. These sorts of war, which the animosity of the different parties, and fanaticism, always carry beyond the bounds of humanity, and the duties of society, have in general no other rules but those of the *offensive* and *defensive*. It has however always been observed, that *civil wars* form great men and good soldiers; because the nobility, citizens, and labourers, being equally obliged to fight for their property and preservation, have all an opportunity of learning the art of war.

Council of WAR, is an assembly of great officers, called by a general, or commander, to deliberate with him on enterprises and attempts to be made. On some occasions, *council of war* is also understood of an assembly of officers, sitting in judgement on delinquent soldiers, deserters, coward officers, &c.

WARASDINS, a kind of Sclavonian soldiers, clothed like the Turks, with a sugar-loaf bonnet instead of a hat. Their arms are a fuzée and pistols; the butt end of their fuzée serves for a spade, when they have occasion to throw up earth.

WAR-CRY, was formerly customary in the armies of most nations, when just upon the point of engaging. Sometimes they were only tumultuous shouts, or horrid yells, uttered with an intent to strike terror into their adversaries; such as is now used by the Indians in America, called the *war-whoop*.

WARREN, at Woolwich, is the head-quarters for the royal artillery, the royal foundery, royal laboratory, and royal military academy; also famous for proofs and experiments of artillery, and great apparatus of war.

WARWOLF, in *ancient military history*, an engine for throwing stones, and other great masses.

WASHERS, a flat circular ring put on the axle-tree, between the linch-pin and small end of the nave, to prevent the nave rubbing against the linch-pin and wearing it, as likewise to diminish the friction of the nave.

WAY *of the rounds*, in *fortification*, is a space left for the passage of the rounds, between the rampart and the wall of a fortified town. This is not much in use at present.

WEDGE. See COINS.

WEIGHTS, in *military matters*, are those in general use, except in artillery, where hundreds are made use of, each of 112 lb. quarters, each of 28 lb. and pounds, which are averdupois.

The 100lb. of England, Scotland, and Ireland, are equal to

91 lb.	8 oz.		Amsterdam, Paris, &c.
96	8		Antwerp or Brabant;
88	0		Rouen, the viscounty weight
106	0		Lyons, the city weight;
91	8		Paris;
90	9		Rochelle;
107	11		Toulouse & Up. Languedoc;
113	0		Marseilles or Provence;
81	7		Geneva;
93	5		Hamburgh;
89	7		Frankfort, &c.;
137	4	of	Genoa;
132	11		Leghorn;
153	11		Milan;
152	0		Venice;
154	10		Naples;
97	0		Seville, Cadiz, &c.
104	13		Portugal;
112	8		Spain;
96	5		Liege;
112	$\frac{2}{3}$		Russia;
107	$\frac{1}{24}$		Sweden;
89	$\frac{1}{2}$		Denmark.

WELL, in the *military art*, a depth which the miner sinks under ground, with branches or galleries running out from it; either to prepare a mine, or to discover and disappoint the enemy's mine. See SHAFT.

WHEEL, in *artillery*. Their strength is always, or should be, proportional to the weight they carry: the diameters of the wheels of heavy gun-carriages are 85 inches, and those for light field-pieces 52 only. See CARRIAGE.

To WHEEL, a motion that brings any body of men to front on that side where the flank was, which is wheeling to the right or left. If a battalion wheels to the right, the left wing moves first, describing the 4th part of a circle about the file-leader on the right, who is the centre of the motion: if the wheeling is to the left, the contrary is performed.

WHEELINGS, are different motions made both by horse and foot, either to the right or left, or to the right and left about, &c.

General rules for WHEELING. The circle is divided into four equal points: thence, *wheeling* to the right or left, is only a quarter of the circle; *wheeling* to the right or left about, is one half of the circle.

When you *wheel* to the right, you are to close to the right, so near as to touch your right hand man, but without pressing him; and to look to the left, in order to bring the rank about even.

When you *wheel* to the left, you are to close to the left, and look to the right, as above directed. This rule will serve for all *wheeling* by ranks; as when a battalion is marching by subdivisions with their rank open, then each rank *wheels* distinctly by itself, when it comes to the ground on which the ranks before it *wheeled*, but not before.

In *wheeling*, the men are to take particular care neither to open nor close their ranks, and to carry their arms well.

In *wheeling*, the motion of each man is quicker or slower, according to the distance he is from the right or the left; thus, when you *wheel* to the right, each man moves quicker than his right-hand man; and, *wheeling* to the left, each man moves quicker than his left-hand man; the circle that every man *wheels* being larger, according to the distance he is from the hand he *wheels* to; as may be seen by describing several circles within one another, at two feet distance from each, which is nearly the space every man is supposed to take up.

WHEEL-*carriages*, in *artillery*, &c. The whole doctrine thereof, as it stands on a mathematical theory, may be reduced to the following particulars, viz.

1. WHEEL-*carriages* meet with less resistance than any other kind of carriage.

2. The larger the wheels, the easier is the draught of the carriage.

3. A carriage upon four wheels of equal size is drawn with less force than with two of those wheels, and two of a lesser size.

4. If the load be all on the axle of the larger wheels, it will be drawn with less force than if laid on the axis of the lesser wheels; contrary to the common notion of loading carriages before.

5. Carriages go with much less force on *friction-wheels*, than in the common way; all which we hope to explain by experiments.

The theory of wheel-carriages is as follows. Let $APGEM$ (Plate XV. *fig.* 3) be a wheel, ND the horizontal plane on which it moves, EF the height of an obstacle over which it is to be drawn: the wheel arriving at the obstacle, and touching the top E, stands upon the point G, and presses it with its whole weight. Draw OEK, a tangent to the *wheel* in the point E, and meeting the vertical diameter AG produced, in O. Draw the radius EC, and EH perpendicular to AG; and MC, mr, perpendicular to CE, and consequently parallel to the tangent OK. Lastly, draw the radius Cm.

2. Since the *wheel* gravitates in the direction CO, let CO express its weight, pressing the point

point G; this may be resolved into two others, CE and OE; of which CE presses the top of the obstacle, and is wholly sustained by it; the other weight OE draws the wheel down in a direction parallel to the tangent OK. Now let $W = CO$ weight of the *wheel*, $R =$ radius, $H = EF$, the height of the obstacle, and $x = OE$; then since $OE : CO :: HE : CE$, we have $x : W :: HE : R$, whence $x = \frac{W \times HE}{R}$; but, from the nature of the circle, $HE = \sqrt{AH \times HG} = \sqrt{AH \times EF} = \sqrt{2RH - H^2}$; therefore $x = \frac{W \times \sqrt{2HR - HH}}{R}$.

3. A force just equal to the weight x, and acting in opposition to it, that is, drawing the *wheel* upwards in the direction CM parallel to EK, will just be able to make the *wheel* rest on the top of the obstacle at E, without suffering any part of its weight to rest on the horizontal plane at G.

4. Now the force must be increased if it acts in any other direction but that of CM; for let it draw the *wheel* in the direction Cm, between M and E, then the force may be resolved into two others, Cr, and rm, of which Cr draws the *wheel* directly against the top of the obstacle E, and so is destroyed by equal re-action of the point E; what therefore remains to draw it upwards in a direction parallel to OK, is mr, which is less than CM or Cm; and to be made equal thereto, (as it must be to support the *wheel* on the top of the obstacle E) it must be increased in the ratio of Cm to rm, which let be as R to S (for as radius to the sine of the angle which the direction of the force makes with CE). But it is plain, the force rm cannot be increased; but the whole force CM must be increased in the same proportion; that is, when rm becomes $\frac{R}{S} \times rm$, CM will become $\frac{R}{S} \times CM = \frac{R}{S} \times \frac{W \times \sqrt{2RH - H^2}}{R} = \frac{W \times \sqrt{2RH - H^2}}{S}$

5. In order that the *wheels* may be drawn over the obstacle FE, it is necessary the direction of the force should be between CE and CA; for if it were in the direction CE, it could only draw the *wheel* upon or against, but not over the obstacle; and if it acted in the direction CA, it would not make it press against the obstacle, and consequently could not draw it over.

6. Let $F = \frac{W \times \sqrt{2RH - H^2}}{S} =$ the force sufficient to sustain the *wheel* on the top E of the obstacle, it is evident if W, R, H, continue the same, $F = \frac{1}{s}$; that is, the force will always be less as the sine of the angle ECm is greater, 'till $rm = CM$, when the said force is least of all.

7. If W and H be given, or always the same, then $F = \frac{\sqrt{2R - 1}}{R}$ (for here we suppose the force applied to draw in the most advantageous direction, viz. CM, where S become equal to R.) If therefore the radii of four *wheels* be 1, 2, 3, 4, then will $\frac{\sqrt{2R - 1}}{R}$ be 1, $\frac{\sqrt{3}}{2}$, $\frac{\sqrt{5}}{3}$, $\frac{\sqrt{7}}{4}$, or as the numbers 1000, 866, 745, 661. From whence it is evident how much less force is necessary to draw a large *wheel* over any obstacle than a lesser one, when the weight of the *wheels* is the same.

8. If the height of the obstacle H be indefinitely small and given, in which case the tangent OK will coincide with the horizontal line ND, and the point E with the point G, very nearly; and the direction of the force be parallel to ND; then because H^2 is inconsiderable we reject it, and the expression for the force will be $F = \frac{W \times \sqrt{2R}}{R}$, (for H is given, and therefore not expressed). And if W be also given, the force will be $F = \frac{\sqrt{2R}}{R}$, or $F = \frac{\sqrt{R}}{R}$, because 2 is a given quantity; but $\frac{\sqrt{R}}{R} = \frac{1}{\sqrt{R}}$; therefore $F = \frac{1}{\sqrt{R}}$; that is, in case of rough uneven surfaces, the force to draw the *wheel* will be inversely as the square root of the radius or diameter of the *wheel*. Thus, if three *wheels* are in diameter as 1, 4, 9, the force to draw them will be as 3, 2, 1.

9. If $H = o$, that is, if the horizontal plane on which the *wheel* moves be perfectly smooth or plain, then the quantity $\frac{W}{S}\sqrt{2RH - H^2} = o$; whence it appears that no force is required

quired to move a heavy body on an horizontal plane, which is perfectly even.

10. If the height H of the obstacle be proportional to the radius of the *wheel*; that is, if H be as R, and the force draw in a direction parallel to OK; then, because $\frac{\sqrt{2RH-H^2}}{R} = \frac{\sqrt{2RR-RR}}{R} = \frac{\sqrt{RR}}{R} = 1$, therefore $F = W$, or the force will be proportional to the weight of the *wheel*.

11. If the direction of the force be parallel to the horizontal plane; that is, if Cm be parallel ND; then, because the angle mCE is (in that case) equal to the angle CEH, their sines will be equal, that is, $rm = CH = R - H$; therefore the expression of the force (*art.* 6.) will become $F = \frac{W \times \sqrt{2HR-H^2}}{R-H}$; and if the height be given, it will be $F = \frac{W \times \sqrt{2R-1}}{R-1}$.

12. From the expression $F = \frac{W \times \sqrt{2RH-H^2}}{S}$, we have this equation $\frac{F}{W} = \frac{\sqrt{2HR-H^2}}{S}$, which gives the following analogy $F : W :: \sqrt{2HR-H^2} : S$; that is, the force is to the weight as the sine of the angle ECH (viz. EH) is to the sine of the angle mCE, which the line of direction makes with the line EC.

13. If the obstacle is capable of being depressed, or born down by the *wheel*, the larger the *wheel* the greater will be the force to do this; for since CE represents the whole force with which the *wheel* bears upon the obstacle, and this is resolvable into the two parts CH and HE, of which the former CH being parallel to EF, tends to press it down, it will be expressed by $R - H$; and since H is given, the depressing force will be as $R - 1$, and therefore will increase with R, or the radius of the *wheel*.

14. If the obstacle be such, as that it can neither be surmounted nor depressed, but must be driven forward, the force to do that will be expressed by $HE = \sqrt{2RH-H^2}$, which, since H is given, will be as $\sqrt{R-1}$; but $\sqrt{R-1}$ will be greater in proportion to the R when R is small, than when it is greater. Thus, if $R = 2$, then $\sqrt{R-1} = 1 = \frac{1}{2}R$; but if $R = 5$, then $\sqrt{R-1} = 2$, which is less than $\frac{1}{2}R$; and if $R = 10$, then $\sqrt{R-1} = 3$, which is less than $\frac{1}{3}R$; so that in this respect small *wheels* have the advantage of large ones: but this case seldom happens.

15. The principal advantage of small *wheels* is, that in them the line of traction is not parallel to the horizon as CK (*fig.* 4.) but inclined thereto in a certain angle as CM, making with the horizon the angle MCK; now if CM be parallel to the tangent OK, the whole force will be employed to draw the *wheel* over the obstacle EF; whereas, if the line of traction were parallel to the horizon, the line CK might express the force, which being resolved into the two forces CE and KE, shows that the part CE draws the *wheel* directly upon the obstacle, and is therefore lost by its reaction; and only the part KE remains to draw the *wheel* over the said obstacle; and consequently the horizontal direction is not the best, unless upon a smooth and even surface, where no obstacles and ascents are to be surmounted.

16. From what has been said, it is evident that a small *wheel*, whose radius is KE, and the line of traction parallel to OK, is equivalent to a large *wheel* whose radius is CK, and the line of traction parallel to the horizon ND; but $EK : CK :: HB : CB :: CI : CE$; that is, the radius of the smaller *wheel* is to that of the larger, as the co-sine of the angle ECG to radius.

17. Though the force employed be never wholly spent in drawing, but when the direction is CN, (*fig.* 5.) parallel to the plane on which the *carriage* moves; yet if it be applied in that oblique direction CM, where the breast of the horse is higher than the axle of the *wheel* C, in which case only the part BM is employed in drawing, the other part CB is not however wholly lost, but is acting contrary to the gravity of the *carriage*, and by that means lessens somewhat of the weight of the load, by lifting it (as it were) along; for in this case the horse not only draws, but also carries along (in some measure) the load.

18. On the contrary, if the axle of the wheel be higher from the plane than the breast of the horse, that is, if the power be applied in the oblique direction CO, then the part DO draws the load along; but the part CD acting perpendicular on G, draws the load directly against the plane, and therefore increases the weight of the load, or the difficulty in drawing it; and is therefore the worst direction in which the force can be any how applied in drawing. Hence it follows, that (*cæteris paribus*) where the *wheels* of a carriage have their radius equal

to the height of the horse's breast, or traces, the draught will be easiest of all; and *wheels*, whose radii are less than that, are better than those *wheels* whose radii exceed it.

19. A small *wheel*, *BDC* (*fig.* 6.) will descend farther down between two obstacles *DF* and *CE*, than a larger *wheel* *ADC*, as is evident from the figure; and therefore the draught is more difficult, and subject to more shocks or jolts, with the small *wheel*, inasmuch as its axis, and consequently the weight of the load, must be raised to a greater height in order to get from between them.

20. Also in soft or yielding ground, a small *wheel* will sink deeper than a larger *wheel* charged with the same weight. Thus suppose *ABC* (*fig.* 7.) be the plane of the road, which is so soft as to permit the small *wheel* to sink down to *E*, then the weight must overcome the resistance of as much earth as the *wheel* in sinking has displaced; that is, as much as is equal to the segment *HED*: if now the larger *wheel* were to sink to the same depth, it must overcome the resistance of so much earth as is equal to the segment *AEC*, which is greater than *HED*; which is impossible, because the same weight can overcome but an equal resistance in either *wheel*; therefore the larger wheel will not sink so deep as the smaller, consequently will be drawn more easily.

21. Since the ends of the axles, and the holes in the naves of large and small *wheels* are equal, and since in passing along, the small *wheel* (to measure the length of the road) must turn round upon its axis oftener than a large one; it follows, that there will be a greater quantity of friction in the small *wheel* than in the larger, and that in the same proportion as it is less, or as its velocity is greater. Hence on account of this, and several other like causes, small *wheels* are much more subject to be out of repair, to be at fault, and to be worn quite out, than larger ones.

22. Next to the conveniency mentioned, *art.* 14, that of turning the carriage in a smaller compass, with small *wheels*, than can be done by large ones, has made them more necessary in waggons and coaches; for, because of their smallness, they can be brought near to, and partly under, the sides of the carriage, and so their axes lying more obliquely under the bed of the carriage, admit it to be turned about with greater ease; but this should have no effect on carriages used in the artillery.

WICKET, a small door in the gate of a fortified place, through which people go in and out, without opening the great gate.

WINDAGE *of a gun, mortar, or howitzer*; the difference between the diameter of the bore, and the diameter of the shot or shell. In England the diameter of the shot is supposed to be divided into 20 equal parts, and the diameter of the bore into 21 of those parts. The French divide the shot into 26, and the bore into 27. The Prussians divide the shot into 24, and the bore into 25. The Dutch nearly the same as the English. The general windage of shells in England is ¼ of an inch, let them be large or small, which is contrary to all reason. It is evident, that the less windage a shot or shell has, the farther and truer it will go; and having less room to bounce from side to side, the gun will not be spoiled so soon.

It is true that some artillery officers say, that the windage of a gun should be equal to the thickness of the ladle; because, when it has been loaded for a while, the shot will not come out, without being loosened thereby, in order to unload it; and when this cannot be done, it must be fired away, and so lost: but in my humble opinion the most advantageous windage should be in dividing the shot into 24 equal parts, and the bore into 25, on account of the convenient scale it affords, not only to construct guns thereby, but also their carriages. Hence, agreeable to this plan, the windage of a 9-pounder will be .166 of an inch, consequently a sufficient thickness for a ladle; and those of a higher calibre become still thicker in proportion: but suppose this thickness is not enough, the loss of a shot is a mere trifle, in respect to the advantage got thereby.

WIND-*gun*. See AIR-GUN.

WINDLACE, is a roller of wood, square at each end, through which are either cross holes for hand-spikes, or staves across to turn it round: by this means it draws a cord, one end of which is fastened to some weight which it raises up. They are used in gins, and about Dutch mortars, to help to elevate them.

WINGS *of an army*, when drawn up in battle, are the right and left hand files; when a battalion is drawn up, the divisions on the right and left are called the wings. The word *wing* is sometimes used to denote the large sides of horn-works, crown-works, tenailles, and the like outworks, &c.

WINTER-*quarters*. See QUARTERS.

WOLF-*holes*, in the defence of places, are round holes, generally about 2 or 3 feet in diameter at the top, 1 at bottom, and 2½ deep, dug in the front of any work. Sometimes a ſharp-pointed ſtake or two are fixed at the bottom, and covered with very thin planks, and green ſods; conſequently the enemy, on advancing, fall in, and are put into confuſion.

WORD, or *Watch-word*. See PAROLE.

WORDS *of command*, are the terms uſed by officers in exerciſing battalions or ſquadrons, or when they are in action.

WORDS *of command uſed at the manual exerciſe, as ordered by* HIS MAJESTY, *viz.*

No.	Words of command	Motions	EXPLANATIONS.
1	*Poiſe your firelock!*	2	1ſt. Seize the firelock with your right hand, and turn the lock outwards, keping the firelock perpendicular. 2d. Bring up the firelock with a quick motion from the ſhoulder, and ſeize it with the left hand, juſt above the lock, ſo that the fingers may lie upon the ſtock, with the elbows down, and the thumb to lie upon the ſtock: the firelock muſt not be held too far from the body, and the left hand muſt be of an equal height with the eyes.
2	*Cock your firelock!*	2	1ſt. Turn the barrel oppoſite to your face, and place your thumb upon the cock, raiſing your elbow ſquare at this motion. 2d. Cock your firelock, by drawing your elbow down, placing your right thumb upon the breech-pin and the fingers under the guard.
3	*Preſent!*	1	Step back about 6 inches to the rear with the right foot, bringing the left toe to the front; at the ſame time the butt-end of the firelock muſt be brought to an equal height with the ſhoulder, placing the left hand on the ſwell, and the fore-fingers of the right-hand before the trigger, ſinking the muzzle a little.
4	*Fire!*	1	Pull the trigger briſkly, and immediately after bringing up the right foot to the inſide of the left, come to the priming poſition, with the lock oppoſite to the right breaſt, the muzzle the height of the hat, keeping it firm and ſteady, and at the ſame time ſeize the cock with the fore-finger and thumb of the right hand, the back of the hand turned up.
5	*Half-cock your firelock!*	1	Half-bend the cock briſkly, with a draw-back of the right elbow, bringing it cloſe to the butt of the firelock.
6	*Handle your cartridge!*	1	Bring your right hand with a ſhort round to your pouch, ſlapping it hard; ſeize the cartridge, and bring it with a quick motion to your mouth; bite the top well off, and bring the hand as low as the chin, with the elbow down.
7	*Prime!*	1	Shake the powder into the pan, placing the three laſt fingers behind the hammer, with the elbow up.
8	*Shut your pans!*	2	1ſt. Shut your pans briſkly, drawing your right arm at this motion towards your body, holding the cartridge faſt in your hand, as in the former poſition. 2d. Turn the piece nimbly round to the loading poſition, with the lock to the front, and the muzzle the height of the chin, bringing the right hand behind the muzzle; both feet kept faſt in this motion.
9	*Charge with cartridge!*	2	1ſt. Turn up your hand, and put the cartridge into the muzzle, ſhaking the powder into the barrel. 2d. Place your hand, cloſed, with a quick and ſtrong motion, upon the rammer.
10	*Draw your rammer!*	2	1ſt. Draw the rammer with a quick motion half out, ſeizing it at the muzzle back-handed. 2d. Draw it quite out, turn it, and enter it into the muzzle.

No.	Words of command	Motions	Explanations.
11	*Ram down your charge!*	1	Ram the cartridge well down the barrel, inſtantly recovering and ſeizing the rammer back-handed at the centre, turning it, and entering it as far as the lower pipe, placing at the ſame the edge of the hand on the butt-end of the rammer, with fingers extended.
12	*Return your rammer!*	1	Return the rammer, bringing up the piece with the left hand to the ſhoulder, ſeizing it with the right hand under the cock, keeping the left hand faſt at the ſwell, turning the body ſquare to the front.
13	*Shoulder your firelock!*	2	1ſt. Quit the left hand, and place it ſtrong upon the butt. 2d Quit the right hand, and throw it down the right ſide.
14	*Reſt your firelock!*	3	1ſt. Seize the firelock with the right hand, turning the lock outwards. 2d. Raiſe the firelock from the ſhoulder, and place your left hand with a quick motion above the lock, holding the piece right up and down in both hands before you, and your left hand even with your eyes. 3d. Step briſkly back with your right foot, placing it a hand's breadth diſtance from your left heel, and the ſame time bring down your firelock as quick as poſſible to the reſt, ſinking it as far down before your left hand as your right hand will permit without conſtraint; your left hand at the feather-ſpring, and your right, with fingers extended, held under the guard, taking care to draw in the muzzle well towards your body, and to dreſs in a line with the butt end.
15	*Order your firelock!*	3	1ſt. Place your firelock nimbly, with your left hand, againſt your right ſhoulder. 2d. Quit the firelock with the right hand, ſinking it at the ſame time with your left; ſeize it at the muzzle, which muſt be of an equal

No.	Words of command	Motions	Explanations.
			height with your chin, and hold it cloſe againſt your right ſide. 3d. Lift up your right foot, and place it by your left; at the ſame time throw back your left hand by your left ſide, and with your right bring down the butt end ſtrong upon the ground, placing it even with the toe of your right foot; the thumb of your right hand lying along the barrel, and the muzzle kept at a little diſtance from your body.
16	*Ground your firelock!*	4	1ſt. Half face to the right upon your heels, and at the ſame time turn the firelock, ſo that the lock may point to the rear, and the flat of the butt-end lie againſt the inſide of your foot; at the ſame time ſlipping the right foot behind the butt of the firelock, the right toe pointing to the right, and the left to the front. 2d. Step directly forward with your left foot, about as far as the ſwell of the firelock, and lay it upon the ground, your left hand hanging down by your left leg, and your right kept faſt, with the butt-end againſt it. 3d. Raiſe yourſelf up again nimbly, bringing back your left foot to its former poſition, keeping your body faced to the right. 4th. Face again to the left upon your heels, and come to your proper front, letting your hands hang down without motion.
17	*Take up your firelock!*	4	1ſt. Face to the right upon both heels. 2d. Sink your body down, and come up to the poſition deſcribed in the ſecond motion of grounding. 3d. Raiſe yourſelf and firelock, bringing it cloſe to your right ſide. 4th. Come to your proper front, ſeizing your firelock at the muzzle, as in *Explanation* 15.
18	*Reſt your firelock!*	3	1ſt. Bring your right hand as far as the ſwell.

2d. Raiſe

No.	Words of command	Motions	Explanations.
			2d. Raiſe the firelock high up in a perpendicular line from the ground with your right hand, and ſeize it with your left above the ſpring; the cock the height of the waiſt-belt. 3d. Step back with your right foot, placing it behind your left heel, and come to the reſt.
19	*Shoulder your firelock!*	2	1ſt. Lift up your right foot, and place it by your left; bring the firelock at the ſame time to your left ſhoulder, and ſeize the butt end with the left hand, keeping it in the ſame poſition as above deſcribed. 2d. Throw your right hand briſkly back.
20	*Secure your firelock!*	3	1ſt. Bring the right hand briſkly up, and place it under the cock, keeping the firelock ſteady in the ſame poſition. 2d. Quit the butt with the left hand, and ſeize the firelock with it at the ſwell, bringing the elbow cloſe down upon the lock; the right hand kept faſt in this motion, and the piece ſtill upright. 3d. Quit the right hand, and bring it down your right ſide, bringing the firelock nimbly down to the *ſecure*; the left hand in a line with the waiſt-belt.
21	*Shoulder your firelock!*	3	1ſt. Bring the firelock up to a perpendicular line, ſeizing it with the righthand under the cock. 2d. Quit the left hand, and place it ſtrong upon the butt. 3d. Quit the right hand, and bring it ſmartly down the right ſide.
22	*Fix your bayonet!*	3	1ſt and 2d motions, as in the two firſt of the *ſecure*. 3d. Quit the right hand, and bring the firelock ſmartly down to the left ſide with the left hand, as far as it will admit without conſtraint, ſeizing the bayonet at the ſame time with the right hand, and fixing it, placing that hand juſt below the braſs, with the piece kept cloſe to the hollow of the ſhoulder.
23	*Shoulder your firelock!*	3	1ſt. Quit the right hand, and bring up the firelock with the left; ſeize it again under the cock with your right, as in the 2d motion of the *ſecure*. 2. Quit the left hand, and place it ſtrong upon the butt. 3d. Quit the right hand, and bring it down the right ſide.
24	*Preſent your arms!*	3	As explained in the 3 motions of the 14th word of command.
25	*To the right face!*	3	1ſt. Bring up the firelock with a quick motion high before you, 'till your left hand comes even with your eyes, with the fingers of that hand extended along the ſtock, juſt above the feather-ſpring; the right foot to be brought cloſe up to the left heel in this motion. 2d. Face to the right, taking care in facing to hold the firelock right up and down, and ſteady in your hands. 3d. Step back with your right foot, and come down to your *preſent*, as in the foregoing explanation.
26	*To the right face!*	3	As in the foregoing explanation, facing to the right.
27	*To the right-about face!*	3	As in the 25th explanation, only coming to the right-about, inſtead of to the right.
28	*To the left face!*	3	1ſt. Bring the right foot briſkly to the hollow of your left with the firelock, in the ſame poſition as in the firſt motion of *facing to the right*. 2. Face to the left. 3. Come down to the *preſent*, as before.
29	*To the left face!*	3	As in the foregoing explanation.
30	*To the left about face!*	3	As before, coming to the left-about, inſtead of to the left.
31	*Shoulder your firelock!*	2	As in the two motions of the 19th explanation.
32	*Charge your bayonet!*	2	1ſt. As in explanation 1. 2d. Bring the ſwell of the firelock down ſtrong upon the palm of the hand, graſping the piece at the ſmall, behind the lock, and as high as the waiſt-belt; the firelock

No.	Words of command	Motions	Explanations.
			lock upon a level with the barrel upwards.
33	*Shoulder your firelock!*	2	1ſt. Bring up the firelock to the ſhoulder, place the left hand upon the butt, bringing the feet ſquare to the front. 2d. Quit the right hand, and throw it down the right ſide.
34	*Advance your arms!*	4	1ſt and 2d, as in the 1ſt explanation. 3d. Bring the firelock down the right ſide, with the right hand, as low as it will admit without conſtraint, ſlipping up the left hand at the ſame time to the ſwell, the guard between the thumb and fore-finger of the right hand, the three laſt fingers under the cock, with the barrel to the rear. 4th. Quit the left hand.
35	*Shoulder your firelock!*	4	1ſt. Bring up the left hand, and ſeize it at the ſwell. 2d. Come ſmartly up to the poiſe. 3d and 4th. Shoulder.
36	*Prime and load!*	15	1ſt. Come ſmartly to the *recover*, by ſpringing the firelock ſtrait up with the left hand, turning the barrel inwards to the proper height of the recover: at the ſame time that the left hand ſprings the firelock, the right hand is raiſed briſkly from the right ſide, and ſeizes the firelock acroſs the breaſt; as it riſes below the cock, the left hand comes with a quick motion from the butt, and ſeizes the firelock ſtrong above the lock, the little finger of the left hand at the ſpring of the lock, the left hand at an equal height with the face, the butt cloſe to the body, but not preſſed, the firelock perpendicular, oppoſite the left ſide of the face. 2d. Bring the firelock down with a briſk motion to the priming poſition, the left hand holding the firelock, as in priming; the thumb of the right hand placed againſt the face of the ſteel, the fingers clinched, and the elbow a little turned out, that the wriſt may be clear of the cock. 3d. Open the pan by throwing up the ſteel with a ſtrong motion of the right arm, turning the elbow in, and keeping the firelock ſteady in the left hand. 4th. Handle your cartridge. 5th. Priming. 6th. Shut your pans. 7th. Caſt about. 8th and 9th. Load. 10th and 11th. Draw rammers. 12th. Ram down the cartridge. 13th. Return the rammers. 14th and 15th. Shoulder. N. B. The motion of recover, and coming down to the priming poſition, and opening pans, to be done in the uſual time. The motions of handling cartridge to ſhutting the pans, to be done as quick as poſſible: when the pans are ſhut, a ſmall pauſe is to be made, and then caſt about together; then the loading motions are to be done as quick as poſſible; but before the rammer is returned, another ſmall pauſe is to be made, counting 1, 2, between each motion, 'till the firelock is ſhouldered.
	Front rank, make ready!		Spring the firelock briſkly to the *recover*, keeping the left-foot faſt in this motion: as ſoon as the firelock is at the *recover*, without any ſtop, ſink the body briſkly without ſtooping forward, with a quick motion down upon the right knee: the butt end of the firelock at the ſame time falls upon the ground; the front part of the butt to be in a line with the heel of the left foot. So ſoon as the butt comes to the ground, the firelock is to be cocked, immediately ſeizing the cock and ſteel in the right hand; the firelock to be held firm in the left hand, about the middle of that part of the firelock between the lock and the ſwell of the ſtock; the point of the left thumb to be cloſe to the ſwell, pointing upwards.

No.	Words of command	Motions	EXPLANATIONS.
			As the body is ſinking, the right knee is to be thrown as far back as the left leg may be right up and down; the right foot to be thrown a little to the right; the body to be kept ſtraight; the head up, looking to the right along the rank, the ſame as if ſhouldered; the firelock to be upright, and the butt about 4 inches to the right of the inſide of the left foot.
	Preſent!	1	Bring the firelock briſkly down to the *preſent*, by extending the left arm to the full length with a ſtrong motion; at the ſame time ſpring up the butt by the cock with the right hand, and raiſe up the butt ſo high upon the right ſhoulder, that you may not be obliged to ſtoop too much with the head; the right cheek to be cloſe to the butt, and the left eye ſhut, and look along the barrel with the right eye from the breech-pin to the muzzle; keep the left elbow down in an eaſy poſition, and ſtand as ſteady as poſſible; the thumb of the right hand to remain in the poſition, as deſcribed in the 3d Explanation of the Manual.
	Fire!	1	Pull the trigger, as directed in the Manual, and as ſoon as the piece is fired, give yourſelf a ſtrong ſpring upon your left leg, raiſing your body briſkly, and ſtraight up, keeping your left foot faſt, and bringing the right heel to the inſide of the left; at the ſame time the firelock is to be brought up to the priming poſition, and half-cocked immediately; a ſhort pauſe is to be made, then handle cartridge, and go on with the loading motions deſcribed in the Explanation of *prime and load*.
	Centre rank, make ready!		Spring the firelock briſkly to the *recover*; ſo ſoon as the left hand ſeizes the firelock above the lock, the right elbow is to be nimbly raiſed a little, placing the

WOR

No.	Words of command	Motions	EXPLANATIONS.
			thumb of that hand upon the cock; the fingers open by the plate of the lock, and as quick as poſſible force the piece to the cock, by dropping the elbow, and forcing down the cock with the thumb, ſtepping at the ſame time a moderate pace to the right, keeping the left foot faſt: as the firelock is cocked, the thumb is to fall below the cock, the right hand ſeizing the firelock cloſe under the cock, firmly; the fore-finger not to be before the trigger; the piece to be held in this poſition perpendicular, oppoſite the left ſide of the face, the butt cloſe to the left breaſt, but not preſſed; the body to be ſtraight, and as full to the front as poſſible; the head kept up, looking to the right of the rank, that the body and the firelock may not ſtoop forward, nor lean much out of the rank.
	Preſent!	1	Spring the firelock from the body to the arm's length with a quick motion, preſſing down the muzzle with the left hand, and ſpring up the butt with the right hand, as in the foregoing Explanation of the *front rank*.
	Fire!	1	As in Explanation 4, in the Manual, with this difference, that the left foot is to be brought up to the right, at the ſame time that the firelock is brought down to the priming poſition.
			The loading motions as in the explanations of priming and loading, and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file-leaders.
	Rear rank make ready!	1	Recover the firelock, and cock as before directed for the centre rank: as the firelock is recovered and cocked, ſtep briſkly ſtraight to the right, with the right foot a full pace; bring the left heel about 6 inches before the right foot; the body ſtraight, and as ſquare to the front as poſſible, as in Explanation of the *centre rank*.

As

No.	Words of command	Motions	Explanations.
	Present!	1	As in Explanation *present*, before.
	Fire!	1	As in Explanation of the *centre rank*, and as the firelock is coming down to the priming position, the left is to be brought back to the right; and at the last motion of shouldering, to spring to the left again, and cover the file-leader.

The WORD, *Watch*-WORD, is a peculiar word that serves for a token and mark of distinction, given out in the orders of the day in time of peace, but in war time every evening in the field by the general who commands, and in garrison by the governor, or other officer commanding in chief, to prevent surprise, and hinder an enemy, or any treacherous person to pass backwards and forwards. This *watch-word* is generally called the *parole*, and to which is added the *countersign*. The first is known to all officers and non-commissioned officers, the latter only to the sentinels. The parole is this day, at Coxheath camp, *England*, and the countersign, *Amherst*. The officers that go the rounds, or patroles, exchange the word with the officers on duty; nor will the sentinels let any one pass that has not got the countersign.

WORDS *of command used at the manual exercise of the grenadiers, when apart from the battalion.*

No.	Words of command	Motions	Explanations.
1	*Grenadiers, take care!*	1	The grenadiers bring the right hand briskly to the front of their caps; pause a little, and bring them down with a slap on their pouches, with life; in which motions, neither your heads, bodies, nor firelocks, are to move. N. B. *Poise your firelock! Cock your firelock! Present! Fire!* as in N°. 1, 2, 3, and 4, of the Manual Exercise.
2	*Sling your firelocks!*	3	1st. Bring the sling with the left hand opposite to the right shoulder, and the firelock with the right hand opposite the left shoulder, by crossing of both hands at the same time, bringing the left hand within the right, keeping the muzzle upright, the barrel to the left, and the right hand just under the left elbow. 2d. Bend the firelock back, and bring the sling over your head, placing it just above your right shoulder. 3d. Draw the sling with your left hand, and let go the firelock with the right at the same time, that it may hang by the sling on the right shoulder, the muzzle upwards, dropping both hands down by your sides at the same time.
3	*Handle your matches!*	3	1st. Bring both hands directly before you with half-stretched-out arms, about the height of your shoulders, taking hold of the lower end of the match with the right hand, placing the thumb under, and the two fore-fingers above. 2d. Bring the match with the right hand over the back of the left, placing it between the thumb and 2 fore-fingers of the said hand. 3d. Push out your left hand with the match straight forward, by extending the arm at full length, and at the same time bring your right hand down to your right side.
4	*Handle your grenades!*	3	1st. Keep your left hand extended to the front, as before, and face nimbly to the right, stretching out your right arm at the same time the height of your shoulder, pointing directly to the rear. 2d. Clap your right hand briskly

on

No.	Words of command	Motions	Explanations.
			on your pouch, ſeizing your grenade. 3d. Bring your right hand to its former poſition, placing the thumb againſt the fuze.
5	*Open your fuze!*	3	1ſt. Keep your left hand extended to the front, and bring the grenade with your right hand to your mouth. 2d. Open the fuze with your teeth. 3d. Puſh your arm briſkly from you, to its former place.
6	*Guard your fuze!*	1	Cover your fuze with your thumb, without making any other motion.
7	*Blow your matches!*	2	1ſt. Bring the match with your left hand before your mouth. 2d. Blow it off with a ſtrong blaſt, puſhing back your hand at the ſame time to its former poſition.
8	*Fire and throw your grenades!*	3	1ſt. Meet the grenade with your left hand oppoſite to your right thigh, inclining your body to the right ſide, bending the right knee, and keeping the left ſtiff, firing the fuze at the ſame time. 2d. Let the fuze be well lighted; then throw the grenade with a ſtiff arm, ſtepping forward at the ſame time with the right foot, placing it in a line with the left, extending both arms in a direct line to the front, keeping the left uppermoſt, and the body upright.

No.	Words of command	Motions	Explanations.
			3d. Bring your right hand down to your ſide, keeping your left in its former poſition.
9	*Return your matches!*	3	1ſt. Bring both hands before you, as directed by the firſt motion of Explanation 3. 2d. Bring the match back to its former place, between the 2 laſt fingers of the left hand. 3d. Let both hands fall down by your ſides.
10	*Handle your ſlings!*	3	1ſt. Seize the ſling with both hands at the ſame time, taking hold of it with the right hand about the middle, and as low as you can reach, without bending your body. 2d. With the left hand bring the butt forwards, ſlipping your left elbow under the firelock, by bringing it between the firelock and the ſling; taking hold of the firelock at the ſame time with the left hand, letting the ſtock lie between the thumb and fore finger, the butt end pointing a little to the left with the barrel upwards. 3d. Bring the firelock to lie on the left ſhoulder, and the ſling on the right, the barrel upwards, and the butt end pointing directly to the front, keeping the firelock to a true level. N. B. The reſt of the exercife is the ſame as the regiment.

WORDS *of command uſed by the cavalry on horſeback.*

It is preſumed that the men are taught to ride, and the horſes dreſt, in order to perform the following exerciſe.

No.	Words of command	Explanations
		[N. B. That no movement be made until the word *march* is given.]
1	*Centre & rear rank move forward to cloſe order. March!*	The two rear ranks of each ſquadron march forward and cloſe ſo near, that only 4 men may juſt wheel round between each rank. The quarter-maſters to be on the right of their reſpective ſquadrons, to give the ranks their proper diſtance, and to dreſs them, and then repair to their poſts in the rear. This movement is to be done at a walk, and the men are to obſerve their right and left-hand men, that the ranks may be even in marching.
2	*Officers rein back into the front rank!*	At this word of command, the front rank of each ſquadron is to open a little to the right and left, to make proper intervals for the officers to fall into, who are to

 wait

No.	Words of command	Motions	Explanations.
			wait for the following word of command.
3	*March!*		The officers rein back in a direct line into the front rank of the men, and dreſs with them: the cornets are to take the ſtandards from the men.
4	*Shorten your bridles!*	5	1ſt. Seize the upper end of the reins of the bridle, which is to lie on the right ſide of the horſe, with the right hand. 2d. Bring it up as high as your chin, keeping your right elbow on a level with the ſhoulder. 3d. Slip your left hand along the reins of the bridle, and take hold of the loop or button, which is near the upper end of the reins. 4th. Slip the loop down with the left hand as low as the pomel of the ſaddle. 5th. Bring the right hand down with life on the right holſter-cap, quitting the reins of the bridle with both hands.
5	*Make ready your carbines!*	1	Unfaſten the ſtrap that holds the carbine; then bring your arm under it, ſeizing it about the middle with the right hand, letting it lie between the fore finger and thumb, and raiſing it a little, that the muzzle may run up by the point of the right ſhoulder.
6	*Advance your carbines!*	3	1ſt. Raiſe your carbine upright in the bucket, ſlipping your hand at the ſame time up the barrel as high as the ſhoulder, with the elbow ſquare. 2d. Slip the right hand down the barrel as low as you can without inclining the body, and graſp it with a full hand. 3d. Bring up the carbine with the right hand, and place the butt end on the upper part of the right thigh, near the body, turning the barrel towards you at the ſame time, the muzzle ſloping to the front.
7	*Handle your ſwivels!*	2	1ſt. Seize the ſwivel with your left hand, placing the thumb on the ſpring. 2d. Bring the ſwivel to the left ſide of the carbine, oppoſite to the ring which you are to ſpring it to, raiſing your elbow as high as your hand.
8	*Spring your carbines!*	3	1ſt. Open the ſwivel, by preſſing your left thumb, and put it into the ring of the carbine, and then eaſe your thumb that the ſpring may cloſe. 2d. Quit the carbine with the right hand, and take hold of the ſmall part of the butt a little below the lock with a full hand. 3d. Quit the ſwivel with the left hand, and bring it to its proper place.
9	*Drop your carbines!*	1	Drop the carbine on the right ſide, hanging by the ſwivel, and the muzzle lying croſs the middle of the right toe; at the ſame time taking hold of the bridle with the left hand, and quitting the carbine with the right.
10	*Join your right hands to your ſwords!*	1	Bring your right hand over your left arm, which arm you are to preſs cloſe to your left ſide, and ſeize the handle of the ſword with a full hand.
11	*Draw your ſwords!*	2	1ſt. Draw your ſword quite out of the ſcabbard, by raiſing up the right hand as high as your arm will permit, and keep the point of the ſword a little higher than the hilt. 2d. Bring your right hand to your right ſide, placing the inſide of the hilt on the outſide of your right thigh, the wriſt bending a little out, raiſing the point very high, in a right line with the right ear of the horſe, with the edge from you.
12	*Place your ſwords in the bridle hands!*	2	1ſt. Bring up the ſword oppoſite to the centre of the body, reſting the pomel on the fore part of the ſaddle, the broad part of the blade towards you, and the point upright; at the ſame time you are to ſlip up your left hand along the reins of the bridle as high as your ſhoulder, and ſeize the blade with your left hand, keeping the reins between the

palm

WOR

No.	Words of command	Motions	Explanations.
			palm and it, and ſquaring the left elbow. 2d. Quit the ſword with the right hand, and bring it to its proper place.
13	*Handle your carbines!*	1	Seize the round or ſmall part of the butt with your right hand as high as your ſhoulder, and bring it immediately down to the aforementioned place.
14	*Advance your carbines!*	1	Bring your carbine with your right hand, placing it on your right thigh, as in Explanation 6.
15	*Cock your carbines!*	2	1ſt. Bring the right elbow forward, and place the right thumb on the cock. 2d. Bring down your right elbow to your ſide, cocking the carbine at the ſame time, and ſlipping the thumb off the cock.
16	*Preſent!*	1	Bring up the carbine, and place the butt end firm to the hollow of the right ſhoulder, dropping the muzzle to a level on the right ſide of the ſword, and ſupport it with the fingers of the left hand, which you are to extend for that purpoſe, and place the fore finger of the right hand before the trigger, and the other three on the guard, the thumb in the hollow of the butt, your body inclining a little forward only to preſs againſt the carbine, keeping your head up, and looking ſtraight forward.
17	*Fire!*	1	Draw the trigger briſkly with that finger that was placed before it; but ſhould it not go off with the firſt drawing, you are not to draw it a ſecond time.
18	*Drop your carbines!*	1	Drop your carbines on the right ſide, as in Explanation 9.
19	*Handle your right piſtols!*	1	Bring your right hand round, turning the back towards you, and ſeize the butt of the right piſtol with a full hand.
20	*Draw your right piſtols!*	1	Draw your right piſtol out of the holſter, and bring it to the right ſide of the ſword, extending your arm directly before you, with the muzzle upright.
21	*Cock your piſtols!*	2	1ſt. Bring the piſtol cloſe to your breaſt, keeping the muzzle up, and place your thumb on the cock. 2d. Throw off the piſtol to its former place, cocking at the ſame time, and ſlip your thumb off the cock.
22	*Preſent!*	1	Drop the muzzle to a level, the barrel upward, and place the fore finger on the trigger, as in Explanation 16.
23	*Fire!*	1	Draw the trigger, as in Explanation 17.
24	*Return your piſtols!*	3	1ſt. Place the muzzle of your piſtol in the holſter, the back of your hand turned towards you. 2. Thruſt it quite down. 3. Quit the piſtol, and bring your right hand to its proper place.
25	*Handle your left piſtols!*	1	Do this as in Explanation 19, only the back of your hand from you.
26	*Draw your piſtols!*	1	As in Explanation 20.
27	*Cock your piſtols!*	2	As in Explanation 21.
28	*Preſent!*	1	As in Explanation 22.
29	*Fire!*	1	As in Explanation 17.
30	*Return your piſtols!*	3	As in Explanation 24.
31	*Recover your ſwords!*	2	1ſt. Seize the handle of the ſword with the right hand, graſping it with the thumb upwards. 2d. Bring the ſword to the right thigh, as in Explanation 11; at the ſame time ſlip down your left hand, and take hold of the bridle at the proper place.
32	*Point your ſwords!*	1	Bring your ſword over the left arm, and enter the point in the ſcabbard, and thruſt it ſo far, that you may look over the right arm.
33	*Return your ſwords!*	2	1ſt. Thruſt your ſword up to the hilt. 2d. Bring your hand back to its proper place.
34	*Officers move into the front. March!*		The commiſſioned officers are to march out of the ranks, the cornets bringing the ſtandards with them, and place themſelves at the head of the ſquadrons. As

ſoon

No.	Words of command	Motions	Explanations.
			foon as the officers are clear of the men, the front ranks are to clofe the intervals, made by the officers, to the centre.
35	*Centre and rear ranks rein back to open order. March!*		The centre and rear ranks of each fquadron are to rein back very flow, in a direct line to their former ground, keeping their ranks and files even; of which the quarter-mafters are to take particular care, as alfo that there be a due diftance between the ranks, according to the direction in Article 8.
36	*Handle your arms!*	1	This is to be done as in Explanation 13.
37	*Advance your carbines!*	1	As in Explanation 14.
38	*Unfpring your carbines!*	1	Quit the reins of your bridle, and take hold of the fwivel with the left hand, placing the thumb on the fpring, and opening it; at the fame time take it out of the ring.
39	*Return your fwivels!*	2	1ft. Place the fwivel on your right fide, by thrufting your left hand under your right arm. 2d. Bring your left hand back to its proper place.
40	*Return your carbines!*	4	1ft. Throw the carbine to the right with the right hand, turning the barrel to the front, finking it as low as you can without inclining your body, feizing the barrel at the fame time with your left hand, and keeping the muzzle upright. 2d. Quit the right hand, and bring the carbine with the left hand under the right arm, finking it near the bucket, and at the fame time feize the barrel with the right hand a little above the left. 3d. Place the butt end of the carbine in the bucket, and quit it with the left hand. 4th. Faften the carbine with the ftrap, and place your bridle in your left hand.

WORDS *of command for difmounting, linking the horfes, &c.*

1	*Difmount!*	6	1ft. Take your right foot out of the ftirrup, at the fame time thrufting forward your bridle-hand, keeping the reins faft. 2d. Take a lock of the horfe's mane with the right hand, and put it in the left, over the bridle, and grafp it faft with the left hand. 3d. Take hold with the right hand of the right bar of the faddle, placing your fingers on the infide, and your thumb on the outfide. 4th. Raife yourfelves with the right hand above the faddle, and bring the left leg over to the near or left fide of the horfe, with an upright body, looking full to the right. 5th. Come brifkly to the ground with the right foot, facing full to the rear, and then quit the ftirrup with the left, bringing it down to the ground, and place it even with the other. 6th. Quit the bridle and mane with the left hand, wheeling at the fame time to the left-about on the right heel, and take hold of the left cheek of the bridle with the right hand.
2	*Make ready your links!*		As there are feveral forts of links, there cannot be one method prefcribed for the whole; but as moft regiments link with collars, we will proceed in that way. The collar being faftened by a running knot to a ring on the faddle, a little above the right holfter, the men are to undo the knot with the right hand, taking the rein of the collar out of the ring, and laying it crofs the horfe's neck.

Words *of command used at the exercise of the artillery, together with the number of hands and implements for that purpose.*

On batteries, there are eight men required in the management and exercise of a heavy piece of artillery, who are posted in the following manner.

1st. A non-commissioned officer to superintend the whole: his duty is, to point the gun at the object, and to observe the effects of each shot.

2d. A man to load, placed on the left of the gun. When the piece is to be loaded with a paper or parchment cartridge, he must be provided with a pen-knife or pair of pointed scissars, to cut an oblong hole in the upper part of the cartridge opposite the seam, beginning at the bottom, about 3 inches long, and 2 broad, and double the paper back upon the cartridge, which he then puts into the piece. This opening is to let the priming communicate with the charge.

3d. A man to load with the ladle, to sponge and ram home: his post is on the right of the gun. These two men are carefully to avoid exposing their bodies in the line of fire, while loading.

4th. A man to serve the vent: his post is on the right of the gun, near the breech, but clear of the carriage.

5th. A man to fire: his post is on the left of the gun, near the breech, but clear of the carriage.

6th and 7th. Two men to handle the hand-spikes: they are placed on each side of the carriage.

8th. A man to serve with ammunition from the magazine, waggon, or chest: he is to be provided with a leather pouch, and is to stand about 40 or 50 paces in the rear.

N. B. At exercise, the arms are either piled or placed against the parapet, and the implements ranged in the following manner, viz. a sponge and ladle upon the right; a sponge and wad-hook upon the left; the hand-spikes upon the right and left.

In the field there are 13 men and 1 non-commissioned officer, posted as follows, viz.

1st. A non-commissioned officer to superintend the whole: his chief care is to point the gun, and observe the effects of each shot.

2d. A non-commissioned officer, or an able gunner, to steer and direct the gun: his post is on the left.

3d. A man to fire: his post is on the left of the gun.

4th. A man to serve the vent: his post is on the right of the gun.

5th. A man to load: his post is on the left of the gun, between the muzzle and the wheel.

6th. A man to sponge and ram home: his post is on the right of the gun, between the muzzle and the wheel.

7th. A man to serve with ammunition: his post is on the left of the gun, without the wheel.

8th. A man to serve ammunition from the magazine, waggon, or chest; posted about 30 or 40 paces in the rear of the gun.

9th. Six men at the drag-ropes, which lay hold of the wooden pins; 3 men to each drag-rope.

N. B. The number of men for the drag-ropes must be in proportion to the nature of the guns.

At exercising the slow motions, a hand-spike is laid on the ground in the front of the wheels; the ladle with the mouth downwards on the right, the wad-hook on the left, and the sponge in the centre.

Table *of the number of men requisite for working the under-mentioned guns and howitzers.*

Species	Cannon					Howitzers		
Natures	24	12	9	6	3	8	$5\frac{4}{5}$	$4\frac{2}{5}$
To superintend, non-commissioned officers	1	1	1	1	1	1	1	1
To steer the guns	1	1	1	1	1	1	1	1
To prime and fire	2	2	2	2	2	2	2	2
To load and set home	2	2	2	2	2	2	2	2
To the drag-ropes	12	10	8	6	4	8	4	4
To unload the waggon	4	3	3	2	1	3	2	2
Total	22	19	17	14	11	17	12	12

N. B. The above guns are all of the light sort, except the 8-inch howitzer.

Instead

Instead of Words of Command *at the exercise of artillery, the drum beats* Signals, *viz.*

No.	Signals by the drum.	Explanations.
1	*Preparative.*	To fire two rounds from the flanks to the centre, or more if the officer who commands chuses.
2	*First part of the general.*	To cease firing, as above directed.
3	*March.*	To advance; that is, the men at the drag-ropes advance the pieces in battery, in a direct line.
4	*Preparative.*	The firing commences again, advancing.
5	*First part of the general.*	To cease firing, advancing.
6	*Flam.*	To unhook the drag-ropes, and fix them to the trail of the gun-carriage.
7	*t.*	To retreat; that is, the line begins to retreat, by the men at the drag-ropes, retreating the pieces in battery, firing as they retreat.
8	*First part of the general.*	To halt and cease from firing; at which time the men at the drag-ropes draw up in a line, holding the drag-ropes in their hands, and the men at their proper stations.
9	*Flam.*	To unhook the drag-ropes, and fix them to the draught-rings at the end of the axle-tree; to be in readiness for advancing.
10	*Long-roll.*	To change about; that is, no one should be kept to one particular post, but changed regularly; so that each man be equally acquainted with every part of his duty.

N. B. The Mortar and Howitzer exercise is similar to this. The men are likewise taught to mount and dismount all kinds of artillery, &c. as also to rig and unrig a gin.

WORKMEN, are persons that attend the ammunition, boatsmen, carpenters, smiths, millers, bakers, waggoners, miners, pioneers, &c.

WORKS, are generally understood of the fortifications about the body of a place; as by *out-works* are meant those without the first inclosure. The word is also used to signify the approaches of the besiegers, and the several lines, trenches, &c. made round a place, an army, or the like, for its security.

WOODEN *bottoms*, in *laboratory works*, are cylindrical pieces of wood, of different lengths and diameters, agreeable to the size of the gun: they are hollowed at one end to receive the shot, and the flannel cartridge is fastened to the other end; the whole forming one cartridge, which is put into the piece at one motion.

WOOL-*packs*, in the *art of war*, are frequently ranged in form of a breast-work, because they resist cannon-shot. See Siege.

Y

YEOMAN, in *military affairs*, was anciently a kind of ceremonious title given to the soldiers.

Yeomen *of the guards*, were anciently 250 men of the best rank, under gentry, and of larger stature than ordinary, each being required to be 6 feet high. At present there are but 100 yeomen in duty, and 70 more not in duty; and as any of the hundred dies, his place is supplied out of the 70. This corps was first instituted by Henry VII. anno 1486.

YOUNGER *regiment*, is that which was last raised. See Seniority.

Younger *officer*, is he whose commission is of the latest date, though he be ever so old a man, or have served ever so long in other capacities; and according to these rules, regiments and officers are posted and commanded, See Seniority.

Z

ZIG-ZAG, in the *art of war*, is a line making several angles, in approaching or erecting a work in a siege, &c. to prevent the besiegers from being fired on in a straight line, or enfiladed.

SUPPLEMENT.

*The Words marked * are Omissions; the others, not marked, are further Explanations of Words already mentioned in the Work.*

A

ABLECTI, in *military antiquity*, a choice or select part of the soldiery in the Roman armies, picked out of those called *extraordinarii*.

* ABOLLA, in *military antiquity*, a warm kind of garment, generally lined or doubled, used both by the Greeks and Romans, chiefly out of the city, in following the camp.

* ABSCISSA, in *military mathematics*, signifies any part of the diameter or axis of a curve, contained between its vertex or some other fixed point, and the intersection of the ordinate.

In the parabola, the *abscissa* is a third proportional to the parameter and the ordinate.

In the ellipsis, the square of the ordinate is equal to the rectangle under the parameter and *abscissa*, lessened by another rectangle under the said *abscissa*, and a fourth proportional to the axis, the parameter, and the *abscissa*.

In the hyperbola, the squares of the ordinates are as the rectangles of the *abscissa* by another line, compounded of the *abscissa* and the transverse axis.

But it must be remembered, that the two proportions relating to the ellipsis and hyperbola, the origin of the *abscissas*, or point from whence they began to be reckoned, is supposed to be the vertex of the curve, or, which amounts to the same thing, the point where the axis meets it; for if the origin of the *abscissas* be taken from the centre, as is often done, the above proportions will not be true.

ACADEMY, is more frequently used amongst the moderns for a regular society, or company, of learned persons, instituted under the protection of a prince, for the cultivation and improvement of arts or sciences. Some authors confound *academy* with university; but, though much the same in Latin, they are very different things in English. An university is, properly, a body composed of graduates in the several faculties; of professors, who teach in the public schools; of regents or tutors, and students who learn under them, and aspire likewise to degrees: whereas an *academy* was originally not intended for teaching, or to profess any art, but to improve it; it was not for novices to be instructed in, but for those who were more knowing, for persons of distinguished abilities to confer in, and communicate their lights and discoveries to each other, for their mutual benefit and improvement. The first *academy* we read of, was established by Charlemagne, at the motion of Alcuin: it was composed of the chief wits of the court, the emperor himself being a member.

*ACANZI, in *military history*, the name of the Turkish light-horse that form the van-guard of the Grand Signior's army on a march.

*ACCENDONES, in *military antiquity*, a kind of gladiators, whose office was to excite and animate the combatants during the engagement.

ACCENSI, in *military antiquity*, was also an appellation given to a kind of adjutants, appointed by the tribune to assist each centurion and decurion.

*ACOLUTHI, in *military antiquity*, was a title in the Grecian empire, given to the captain

tain or commander of the *varangi*, or body-guards, appointed for the security of the emperor's palace.

* ACCONTIUM, in *ancient military writers*, a kind of Grecian dart or javelin, somewhat resembling the Roman *pilum*.

ACCOUTREMENTS, should be made of stout, smooth buff, as well for the service to be expected from them, as for their superior look above the spongy kind, which is always stretching, and difficult to clean. The buff belts are about 2¼ inches broad, with two buckles to fix them to the pouch. Pouches are made of the stoutest blackened calf-skin, especially the outside flaps, which are of such a substance as to turn the severest rain. Cartridge-boxes are made as light as possible, with 36 holes in each, to hold so many cartridges. The bayonet-belt is also 2¼ inches broad, and better worn over the shoulder than about the waist.

* ÆNEATORES, in *military antiquity*, the musicians in an army; including those who sounded the trumpets, horns, *litui*, *buccinæ*, &c.

* AGE, in a *military sense*, or that wherein the Romans were obliged to enter themselves in the army, was at 17 years; at 45 they might demand their dismission. Amongst the Lombards, the *age* of entry was between 18 and 19; among the Saxons, at 13.

* AGEMA, in the *ancient military art*, a kind of soldiery chiefly in the Macedonian armies. The word is Greek, and litterally denotes vehemence; to express the strength and eagerness of this corps. Some authors will have *agema* to denote a certain number of picked men, answering to a legion among the Romans.

* AGGER, in *ancient military writers*, denotes the middle part of a military road, raised into a ridge, with a gentle slope on each side, to make a drain for the water, and keep the way dry.

Agger, is also used for the whole road, or military way. Where highways were to be made in low grounds, as between two hills, the Romans used to raise them above the adjacent land, so as to make them of a level with the hills. These banks they called *aggeres*. Bergier mentions several in the *Gallia Belgica*, which were thus raised 10, 15, or 20 feet above ground, and 5 or 6 leagues long. They are sometimes also called *aggeres calceati*, or causeways, as with us.

Agger, also, denotes a work of fortification, used both for the defence and the attack of towns, camps, &c. in which sense, *agger* is the same with what was otherwise called *vallum*, and in latter times, *agestum*; and among the moderns, *lines*; sometimes, *cavaliers*, *terrasses*, &c.

The *agger* was usually a bank, or elevation of earth, or other matter, bound and supported with timber; having sometimes turrets on the top, wherein the workmen, engineers, and soldiery, were placed. It was also accompanied with a ditch, which served as its chief defence. The height of the *agger* was frequently equal to that of the wall of the place. Cæsar tells us of one he made, which was 30 feet high, and 330 feet broad. Besides the use of *aggers* before towns, they generally used to fortify their camps with the same; for want of which precaution, divers armies have been surprised and ruined.

There were vast *aggers* made in towns and places on the sea-side, fortified with towers, castles, &c. Those made by Cæsar and Pompey, at Brundusium, are famous. Sometimes *aggers* were even built across arms of the sea, lakes, and morasses; as was done by Alexander before Tyre, and by M. Antony and Cassius.

The wall of Severus, in the north of England, may be considered as a grand *agger*, to which belong several lesser ones. Besides the principal *agger* or *vallum*, on the brink of the ditch, Mr. Horsley describes another on the south side of the former, about 5 paces distant from it, which he calls the south *agger*; and another larger one, on the north side of the ditch, called the north *agger*. This latter he conjectures to have served as a military way; the former, probably, was made for the inner defence, in case the enemy should beat them from any part of the principal *vallum*, or to protect the soldiers against any sudden attack from the provincial Britons.

Agger *Tarquinii*, was a famous fence built by Tarquinius Superbus, on the east side of Rome, to stop the incursions of the Latins, and other enemies, whereby the city might be invested.

Agger, is also used for the earth dug out of a ditch or trench, and thrown upon the brink of it: in which sense, the Chevalier Folard thinks the word to be understood, when used in the plural number, since we can hardly suppose they would raise a number of cavaliers, or terrasses.

Agger, is also used for a bank or wall, erected against the sea, or some great river, to confine or keep it within bounds; in which sense, *agger* amounts to the same with what the ancients called *tumulus* and *moles*; the Dutch, *dyke*; and we, *dam*, *sea-wall*, &c.

* AGIADES, in the *Turkish armies*, are a kind of pioneers, or rather field-engineers, employed in fortifying camps, &c.

* ALLÆ, in the *ancient military art*, the two wings or extremes of an army ranged in order of battle.

ALLIANCES, are variously distinguished, according to their object, the parties in them, &c. Hence we read of equal, unequal, triple, quadruple, grand, offensive, defensive *alliances*, &c. See ALLIANCE, in the first Alphabet.

ALTITUDE *of a figure*, is the distance of its vertex from its base, or the length of a perpendicular let fall from the vertex to the base.

ALTITUDE *of a shot or shell*, is the perpendicular height of the principal vertex above the horizon. See GUNNERY and PROJECTILES.

ALTITUDE, in *optics*, is usually considered as the angle subtended between a line drawn through the eye, parallel to the horizon, and a visual ray emitted from an object to the eye.

ALTITUDE, in *cosmography*, is the perpendicular height of an object, or its distance from the horizon upwards.

ALTITUDES are divided into *accessible* and *inaccessible*.

Accessible ALTITUDE *of an object*, is that whose base you can have access to, i. e. measure the nearest distance between your station and the foot of the object on the ground.

Inaccessible ALTITUDE *of an object*, is that when the foot or bottom of it cannot be approached, by reason of some impediment; such as water, or the like. The instruments chiefly used in measuring of *altitudes*, are the quadrant, theodolite, geometric quadrant, or line of shadows, &c.

ALTITUDE *of the eye*, in *perspective*, is a right line let fall from the eye, perpendicular to the geometrical plane.

AMMUNITION, or *gun-powder*, may be prohibited to be exported at the king's pleasure, by Car. II. cap. 4. § 13.

AMMUNITION. Arms, utensils of war, or gunpowder, imported without licence from his majesty, are to be forfeited with treble the value. Such licence obtained, except for the furnishing his majesty's public stores, is to be void, and the offender to incur a premunire, and be disabled to hold any office from the crown. See AMMUNITION, in the first Alphabet.

Proportion of AMMUNITION *for the following troops for one year, commencing the 25th of March, 1760, agreeable to the king's warrant, in time of peace.*

		Pow.	Ball			Flints		
		Barrels	Musquets	Carbines	Pistols	Musquets	Carbines	Pistols
			C.	C.	C.	N°.	N°.	N°.
A regiment of foot of 900 men	service	13½	35	—	—	2700	—	—
	exercise	19	11	—	—	1800	—	—
A reg. of dragoons of 360 men	service	5	9	—	2	1134	—	2263
	exercise	7	1	—	—	756	—	1512
A light troop of 121 men	service	2½	—	7	—	—	363	393
	exercise	1½	—		—	—	242	262

N. B. The proportion of *ammunition* for a regiment of foot is 64 rounds for each man for service, at 6 drams each cartridge; and 135 rounds for each man for exercise, at ¼ of an ounce.

Musquet-flints, 3 to each man for service, and 2 for exercise.

Musquet-balls, 20 to each man for exercise.

The proportion for a regiment of dragoons is, 1lb. of powder for service, and 2lb. for exercise, to each man; each cartridge to contain the same as those of the foot.

The proportion for the light-dragoons is 64 rounds for each man for service, at ½ an ounce each cartridge, and 405 rounds each man, for exercise, at 3 drams each cartridge.

The royal regiment of artillery, as much as the commanding officer thinks proper.

The militia when embodied to have the same as a regiment of foot, according to their numbers.

* ANACLETICUM, in the *ancient art of war*, a particular blast of the trumpet, whereby the fearful and flying soldiers were rallied and recalled to the combat.

* ANDABATÆ, in *military antiquity*, a kind of gladiators, who fought hoodwinked; having a sort of helmet that covered the eyes and face.

They were called *andabatæ, quasi* ἀναβάτι, *ascensores*, because they fought mounted on horseback, or out of chariots.

* ANGARIA, in *ancient military writers*, means a guard of soldiers posted in any place for the security of it.

ANGON, in *ancient military history*, a kind of javelin used by the French. The iron head of it resembles a fleur-de-lis; and it is the opinion of some writers, that the arms of France are not fleurs-de-lis, but the iron point of the *angon* or javelin of the ancient French. See ANGON, in the first Alphabet.

* AQUEDUCTS, in *military architecture*, are generally made to bring water from a spring or river to a fortress, &c. they are likewise used to carry canals over low ground, and over brooks or small rivers: they are built with arches like a bridge, only not so wide, and are covered above by an arch, to prevent dust or dirt from being thrown into the water. See Muller's *Practical Fortification*.

ARAIGNE. See GALLERY and MINE.

ARBALET, in the *ancient art of war*, a cross-bow, made of steel, set in a shaft of wood, with a string and trigger, bent with a piece of iron fitted for that purpose, and used to throw bullets, large arrows, darts, &c.

ARCHERS, in *military history*, a kind of militia or soldiery, armed with bows and arrows. They were much used in former times, but now laid aside, excepting in Turkey, and some of the eastern countries.

ARCHERY, the art of shooting with bow and arrow. It is forbid, by statute, to shoot at a standing mark, unless it be for a rover, where the *archer* is to change his mark at every shot. Any person above 24 years old is also forbid to shoot with any prick-shaft, or flight, at a mark of eleven score yards or under. 33 Hen. VIII. chap. 9. The former was a provision for making good marksmen at fight; the latter, for giving strength and sinews. See ARCHERY, in the first Alphabet.

ARMATURA, is also an appellation given to the soldiers who were light-armed. Aquinus seems, without reason, to restrain *armatura* to the *tyrones*, or young soldiers, in it. Under this word is understood, the throwing of the spear, javelin, shooting with bows and arrows, &c.

ARMATURA, is also a denomination given to the soldiers in the emperor's retinue. See ARMATURA, in the first Alphabet.

ARMS, in a *general sense*, includes all kinds of weapons, whether for defence or offence. It is supposed, that the first artificial arms were of wood, and only employed against beasts; and that Belus, the son of Nimrod, was the first that waged war: whence, according to some, came the appellation *bellum*. Diodorus Siculus takes Belus to be the same with Mars, who first trained soldiers up to battle. *Arms* of stone, and even of brass, appear to have been used before they came to iron and steel. Josephus assures us, that the patriarch Joseph first taught the use of iron arms in Egypt, arming the troops of Pharoah with a casque and buckler.

The principal *arms* of the ancient Britons were hatchets, scythes, lances, swords, and bucklers: the Saxons, &c. brought in the halberd, bow, arrows, arbalets, &c. By the ancient laws of England, every man was obliged to bear arms, except the judges and clergy. Under Henry VIII. it was expressly enjoined on all persons to be regularly instructed, even from their tender years, in the exercise of the *arms* then in use, viz. the long-bow and arrows; and to be provided with a certain number of them.

By the common law, it is an offence for persons to go or ride armed with dangerous weapons; but gentlemen, both in and out of the army, may wear common armour, according to their quality. The king may prohibit force of *arms*, and punish offenders according to law; and herein every subject is bound to be aiding. Stat. 7 Edw. I. None shall come with force and *arms* before the king's justices, nor ride armed in affray of the peace, on pain to forfeit their armour, and to suffer imprisonment, &c. 2 Edw. III. c. 3. The importation of *arms* and ammunition is prohibited by 1 Jac. II. c. 8, and by William and Mary, stat. 2. c. 2. So likewise *arms*, &c. shipped after prohibition, are forfeited, by 29 Geo. I. c. 16. sec. 2.

ARMS *of parade*, or *courtesy*, were those used in the ancient justs and tournaments; which were commonly unshod lances, swords without edge or point, wooden swords, and even canes. See ARMS, in the first Alphabet.

ARMY. Our armies anciently were a sort of militia, composed chiefly of the vassals and tenants of the lords. When each company had served the number of days or months enjoined by their tenure, or the customs of the fees they held, they returned home.

ARMY *of observation*, is employed to watch and observe the motions of an enemy; and by besiegers, to prevent relief being brought into a place, or the siege being raised by the enemy. See ARMY, in the first Alphabet.

ARTIFICERS, in a *military sense*, are those who

who make all kinds of fire-works, and prepare all the different ſorts of laboratory ſtores; as alſo, ſmiths, collar-makers, carpenters, wheel-wrights, gun-ſmiths, lock-ſmiths, rope-makers, &c. Moſt of the foreign regiments of artillery have one company of *artificers*.

* ARX, in the *ancient military art*, implies a town, fort, caſtle, &c. for the defence of a place. The *arx*, in ancient Rome, was a diſtinct edifice from the Capitol, though ſome have confounded the two. According to Ryckius, the *arx*, properly ſpeaking, was a place on the higheſt part of the Capitoline mount, ſtronger and better fortified than the reſt, with towers and pinnated walls, in which was alſo the temple of Jupiter Capitolinus.

B

* BANDERET, in *military hiſtory*, implies the commander in chief of the troops of the canton of Bern, in Switzerland.

* BANNERS, in the *horſe equipage*, for the kettle-drums and trumpets, to be of the colour of the facing of the regiment. The badge of the regiment, or its rank, to be in the centre of the banner of the kettle-drums, as on the ſecond ſtandard. The king's cypher and crown to be on the banner of the trumpets, with the rank of the regiment in figures underneath. The depth of the kettle-drum banners to be 3 feet 6 inches; the length 4 feet 8 inches, excluding the fringe. Thoſe of trumpets to be 12 inches in depth, and 18 inches in length.

* BARBET *battery*, in *gunnery*, is when the breaſt-work of a battery is only 3 feet high, that the guns may fire over it without being obliged to make embraſures: in ſuch caſes, it is ſaid the guns fire *en barbet*. See BATTERY, in the firſt Alphabet.

* BATTLEMENTS, in *military affairs*, are the indentures in the top of old caſtles or fortified walls, or other buildings, in the form of embraſures, for the greater conveniency of firing or looking through.

BAT-*men*, } a kind of ſervants in the army,
BAW-*men*, } that take care of the baggage-horſes.

* BAT-*horſes*, } are baggage-horſes belong-
* BAW-*horſes*, } ing to the officers when on actual duty.

* BEACON, a ſignal for the better ſecuring the kingdom from foreign invaſions.

On certain eminent places of the country are placed long poles erect, whereon are faſtened pitch-barrels to be fired by night, and ſmoke made by day, to give notice, in a few hours, to the whole kingdom, of an approaching invaſion.

* BEAR, in *gunnery*. A piece of ordnance is ſaid to *bear*, or come to *bear*, when pointed directly againſt the object; that is, pointed to hit the object

BELTS, in the *army*, are of different ſorts, and for various purpoſes, viz.

Shoulder-BELTS for the dragoon-guards, horſe and dragoons, to be 4½ inches broad; thoſe of the light dragoons to be 2½ inches broad. Regiments that have buff waiſtcoats, are to have buff-coloured accoutrements, and thoſe which have white waiſtcoats, to have white.

Waiſt-BELTS, to be 2¾ inches broad, except thoſe of the light dragoons, which are to be 1¾ inches only; to have yellow buckles or claſps: the horſe to have *croſs belts*; the dragoon-guards and dragoons to have only one *ſhoulder-belt*, except the 8th regiment, which is permitted to wear *croſs-belts*.

BELTS are known among the ancient and middle-age writers by divers names, as *ζωνη*, *ζωνα*, *zona*, *cingulum*, *reminiculum*, *ringa*, and *baldrellus*. The *belt* was an eſſential piece of the ancient armour, inſomuch that we ſometimes find it uſed to denote the whole armour. In latter ages the *belt* was given to a perſon when he was raiſed to knighthood: whence it has alſo been uſed as a badge or mark of the knightly order.

BENDINGS, in *military and ſea matters*, are ropes, wood, &c. bent for ſeveral purpoſes. M. Amontons gives ſeveral experiments concerning the *bending* of ropes. The friction of a rope *bent*, or wound round an immoveable cylinder, is ſufficient, with a very ſmall power, to ſuſtain very great weights. Divers methods have been contrived for *bending* timber, in order to ſupply crooked planks and pieces for building ſhips; ſuch as by ſand, boiling water, ſteam of boiling water, and by fire. See M. Du Hamel, in his book called *Du Tranſport, de la Conſervation, & de la Force des Bois*. M. Deleſme ingeniouſly enough propoſed to have the young trees bent, while growing in the foreſt. The method of *bending* planks by ſand-heat, now uſed in the king's yards, was invented by captain Cumberland.

A method has been lately invented and practiſed for *bending* pieces of timber, ſo as to make the wheels of carriages without joints. The *bending* of boards, and other pieces of timber for

for curved works in joinery, is effected by holding them to the fire, then giving them the figure required, and keeping them in this figure by tools for the purpose.

BENEFICIARII, in *ancient military history*, denotes soldiers who attend the chief officers of the army, being exempted from all other duty.

Ben ficiarii were also soldiers discharged from the military service or duty, and provided with *beneficia* to subsist on.

* BLOCK *battery*, in *gunnery*, a wooden battery for two or more small pieces, mounted on wheels, and moveable from place to place; very ready to fire *en barbet*, in the galleries and casemates, &c. where room is wanted.

* Block-*house*, in the *military art*, a kind of wooden fort or fortification, sometimes mounted on rollers, or on a flat-bottomed vessel, serving either on the lakes or rivers, or in counterscarps and counter-approaches. This name is sometimes given to a brick or stone building on a bridge, or the brink of a river, serving not only for its defence, but for the command of the river, both above and below.

BORE. See Cannon, in the first Alphabet.

BRANCH *of a mine*. See Mine, in the first Alphabet.

BRIDGES. See Bridge, in the first Alphabet.

Bridges are generally placed in a direction perpendicular to the stream in a direct line, to give free passage to the water. They are made of carpentry or masonry. The number of arches of a *bridge* is generally made odd; either that the middle of the stream or chief current may flow freely without interruption of a pier; or that the two halves of the *bridge*, by gradually rising from the ends to the middle, may there meet in the highest and largest arch; or else, for the sake of grace, that by being open in the middle, the eye in viewing it may look directly through there, as we always expect to do in looking at it, and without which opening we generally feel a disappointment in viewing it.

If the *bridge* be equally high throughout, the arches, being all of a height, are made all of a size, which causes a great saving of centering. If the *bridge* be higher in the middle than at the ends, let the arches decrease from the middle towards each end, but so that each half have the arches exactly alike, and that they decrease in span proportionally to their height, so as to be always the same kind of figure. *Bridges* should rather be of few and large arches, than of many and small ones, if the height and situation will allow of it.

Names of all the terms peculiar to Bridges, &c.

Abutment. See *Butments*.

Arch, an opening of a bridge, through or under which the water, &c. passes, and which is supported by piers or butments. *Arches* are denominated circular, elliptical, cycloidal, catenarian, equilibrial, gothic, &c. according to their figure or curve.

Archivolt, the curve or line formed by the upper sides of the voussoirs or arch-stones. It is parallel to the intrados or under side of the arch when the voussoirs are all of the same length; otherwise not.

By the *archivolt* is also sometimes understood the whole set of voussoirs.

Banquet, the raised foot-path at the sides of the bridge next the parapet: it is generally raised about a foot above the middle or horse-passage, and 3, 4, 5, 6, or 7, &c. feet broad, according to the size of the bridge, and paved with large stones, whose length is equal to the breadth of the walk.

Battardeau, or *Coffer-dam*, a case of piling, &c. without a bottom, fixed in the bed of the river, water-tight or nearly so, by which to lay the bottom dry for a space large enough to build the pier on. When it is fixed, its sides reaching above the level of the water, the water is pumped out of it, or drawn off by engines, &c. 'till the space be dry; and it is kept so by the same means, until the pier is built up in it, and then the materials of it are drawn up again. *Battardeaux* are made in various manners, either by a single inclosure, or by a double one, with clay or chalk rammed in between the two, to prevent the water from coming through the sides: and these inclosures are also made either with piles only, driven close by one another, and sometimes notched or dove-tailed into each other; or with piles grooved in the sides, driven in at a distance from one another, and boards let down between them in the grooves.

Butments, are the extremities of a bridge, by which it joins to, or abuts upon, the land, or sides of the river, &c.

These must be made very secure, quite immoveable, and more than barely sufficient to resist the drift of its adjacent arch; so that, if there are not rocks or very solid banks to raise them against, they must be well re-inforced with proper walls or returns, &c.

Caisson, a kind of chest, or flat-bottomed boat, in which a pier is built, then sunk to the bed of the river, and the sides loosened and taken off from the bottom, by a contrivance for that purpose; the bottom of it being left

under

under the pier as a foundation. It is evident therefore that the bottoms of the *caissons* must be made very strong and fit for the foundations of the piers. The *caisson* is kept afloat 'till the pier be built to the height of low-water mark; and for that purpose its sides must either be made of more than that height at first, or else gradually raised to it, as it sinks by the weight of the work, so as always to keep its top above water: and therefore the sides must be made very strong, and kept asunder by cross timbers within, lest the great pressure of the ambient water crush the sides in, and so not only endanger the work, but also drown the workmen within it. The *caisson* is made of the shape of the pier, but some feet wider on every side to make room for the men to work: the whole of the sides are of two pieces, both joined to the bottom quite round, and to each other at the salient angle, so as to be disengaged from the bottom, and from each other, when the pier is raised to the desired height, and sunk. It is also convenient to have a little sluice made in the bottom, occasionally to open and shut, to sink the *caisson* and pier sometimes by, before it be finished, to try if it bottom level and rightly; for by opening the sluice, the water will rush in and fill it to the height of the exterior water, and the weight of the work already built will sink it; then by shutting the sluice again, and pumping out the water, it will be made to float again, and the rest of the work may be completed; but it must not be sunk but when the sides are high enough to reach above the surface of the water, otherwise it cannot be raised and laid dry again. Mr. Labelye tells us, that the *caissons* in which he built Westminster bridge, contained above 150 load of fir timber, of 40 cubic feet each, and was of more tonnage or capacity than a 40-gun ship of war.

Centres, are the timber frames erected in the spaces of the arches to turn them on; by building on them the voussoirs of the arch. As the *centre* serves as a foundation for the arch to be built on, when the arch is completed, that foundation is struck from under it, to make way for the water and navigation, and then the arch will stand of itself from its curved figure. The *centre* must be constructed of the exact figure of the intended arch, convex as the arch is concave, to receive it on as a mould. If the form be circular, the curve is struck from a central point by a radius; if it be elliptical, it should be struck with a double cord, passing over two pins fixed in the focusses, as the mathematicians describe their ellipses; and not by striking different pieces or arcs of circles from several *centres*; for these will form no ellipsis at all, but an irregular misshapen curve made up of broken pieces of different circular arches; but if the arch be of any other form, the several abscissas and ordinates should be calculated; then their corresponding lengths, transferred to the centering, will give so many points of the curve, and exactly by which points bending a bow of pliable matter, the curve may be drawn by it.

The *centres* are constructed of beams of timber, firmly pinned and bound together, into one entire compact frame, covered smooth at top with planks or boards to place the voussoirs on; the whole supported by off-sets in the sides of the piers, and by piles driven into the bed of the river, and capable of being raised and depressed by wedges contrived for that purpose, and for taking them down when the arch is completed. They should also be constructed of a strength more than sufficient to bear the weight of the arch.

In taking the *centre* down, first let it down a little, all in a piece, by easing some of the wedges; then let it rest a few days to try if the arch makes any efforts to fall, or any joints open, or any stones crush or crack, &c. that the damage may be repaired before the *centre* is entirely removed, which is not to be done 'till the arch ceases to make any visible efforts.

Chest. See *Caisson*.

Cofferdam. See *Battardeau*.

Drift, *Shoot*, or *Thrust*, of an arch, is the push or force which it exerts in the direction of the length of the bridge. This force arises from the perpendicular gravitation of the stones of the arch, which being kept from descending by the form of the arch, and the resistance of the pier, exert their force in a lateral or horizontal direction. This force is computed in *Prop*. 10, of Mr. Hutton's *Principles of Bridges*, where the thickness of the pier is determined that is necessary to resist it, and is greater the lower the arch is, *cæteris paribus*.

Elevation, the orthographic projection of the front of a bridge, on the vertical plane, parallel to its length. This is necessary to show the form and dimensions of the arches and other parts, as to height and breadth, and therefore has a plain scale annexed to it, to measure the parts by. It also shows the manner of working up and decorating the fronts of the bridge.

Extrados, the exterior curvature or line of an arch. In the propositions of the second section in Professor Hutton's *Principles of Bridges*, it is the outer or upper line of the wall above the arch;

arch; but it often means only the upper or exterior curve of the vouſſoirs.

Foundations, the bottoms of the piers, &c. or the baſes on which they are built. Theſe bottoms are always to be made with projections, greater or leſs, according to the ſpaces on which they are built: and according to the nature of the ground, depth and velocity of water, &c. the foundations are laid and the piers built after different manners, either in caiſſons, in battardeaux, on ſtilts with ſterlings, &c. for the particular method of doing which, ſee each under its reſpective term.

The moſt obvious and ſimple method of laying the *foundations* and raiſing the piers up to the water-mark, is to turn the river out of its courſe above the place of the bridge, into a new channel cut for it near the place where it makes an elbow or turn; then the piers are built on dry ground, and the water turned into its old courſe again, the new one being ſecurely banked up. This is certainly the beſt method, when the new channel can be eaſily and conveniently made; but which however is ſeldom or never the caſe.

Another method is, to lay only the ſpace of each pier dry 'till it be built, by ſurrounding it with piles and planks driven down into the bed of the river, ſo cloſe together as to exclude the water from coming in; then the water is pumped out of the incloſed ſpace, the pier built in it, and laſtly the piles and planks drawn up. This is coffer-dam work, but evidently cannot be practiſed if the bottom be of a looſe conſiſtence, admitting the water to ooze and ſpring up through it.

When neither the whole nor part of the river can be eaſily laid dry as above, other methods are to be uſed; ſuch as to build either in caiſſons or on ſtilts, both which methods are deſcribed under their proper words; or yet by another method, which hath, though ſeldom, been ſometimes uſed, without laying the bottom dry, and which is thus: the pier is built upon ſtrong rafts or gratings of timber, well bound together, and buoyed up on the ſurface of the water by ſtrong cables, fixed to the other floats or machines, 'till the pier is built; the whole is then gently let down to the bottom, which muſt be made level for the purpoſe: but of theſe methods, that of building in caiſſons is the beſt.

But before the pier can be built in any manner, the ground at the bottom muſt be well ſecured, and made quite good and ſafe, if it be not ſo naturally. The ſpace muſt be bored into, to try the conſiſtence of the ground; and if a good bottom of ſtone, or firm gravel, clay, &c. be met with, within a moderate depth below the bed of the river, the looſe ſand, &c. muſt be removed and digged out to it, and the foundation laid on the firm bottom on a ſtrong grating or baſe of timber made much broader every way than the pier, that there may be the greater baſe to preſs on, to prevent its being ſunk; but if a ſolid bottom cannot be found at a convenient depth to dig to, the ſpace muſt then be driven full of ſtrong piles, whoſe tops muſt be ſawed off level ſome feet below the bed of the water, the ſand having been previouſly digged out for that purpoſe; and then the foundation on a grating of timber laid on their tops as before: or, when the bottom is not good, if it be made level, and a ſtrong grating of timber, 2, 3, or 4 times as large as the baſe of the pier be made, it will form a good baſe to build on, its great ſize preventing it from ſinking. In driving the piles, begin at the middle, and proceed outwards all the way to the borders or margin; the reaſon of which is, that if the outer ones were driven firſt, the earth of the inner ſpace would be thereby ſo jammed together, as not to allow the inner piles to be driven: and beſides the piles immediately under the piers, it is alſo very prudent to drive in a ſingle, double, or triple row of them around, and cloſe to the frame of the *foundation*, cutting them off a little above it, to ſecure it from ſlipping aſide out of its place, and to bind the ground under the pier firmer: for, as the ſafety of the whole bridge depends on the *foundation*, too much care cannot be uſed to have the bottom made quite ſecure.

Jettee, the border made round the ſtilts under a pier. See *Sterling*.

Impoſt, is the part of the pier on which the feet of the arches ſtand, or from which they ſpring.

Key-ſtone, the middle vouſſoir, or the arch-ſtone in the top or immediately over the centre of the arch. The length of the *key-ſtone*, or thickneſs of the archivolt at top, is allowed to be about 1-15th or 1-16th of the ſpan by the beſt architects.

Orthography, the elevation of a bridge, or front view, as ſeen at an infinite diſtance.

Parapet, the breaſt-wall made on the top of a bridge to prevent paſſengers from falling over. In good bridges, to build the parapet but

but a little part of its height cloſe or ſolid, and upon that a baluſtrade to above a man's height, has an elegant effect.

Piers, the walls built for the ſupport of the arches, and from which they ſpring as their baſes. They ſhould be built of large blocks of ſtone, ſolid throughout, and cramped together with iron, which will make the whole as one ſolid ſtone. Their faces or ends, from the baſe up to high-water mark, ſhould project ſharp out with a ſalient angle, to divide the ſtream: or, perhaps the bottom of the pier ſhould be built flat or ſquare up to about half the height of low-water mark, to allow a lodgement againſt it for the ſand and mud, to go over the foundation; leſt, by being kept bare, the water ſhould in time undermine, and ſo ruin or injure it. The beſt form of the projection for dividing the ſtream, is the triangle; and the longer it is, or the more acute the ſalient angle, the better it will divide it, and the leſs will the force of the water be againſt the pier; but it may be ſufficient to make that angle a right one, as it will make the work ſtronger; and in that caſe the perpendicular projection will be equal to half the breadth or thickneſs of the pier. In rivers, on which large heavy craft navigate and paſs the arches, it may perhaps be better to make the ends ſemicircular; for, although it does not divide the water ſo well as the triangle, it will both better turn off and bear the ſhock of the craft.

The thickneſs of the *piers* ſhould be ſuch as will make them of weight or ſtrength ſufficient to ſupport their interjacent arch independent of any other arches; and then, if the middle of the *pier* be run up to its full height, the centering may be ſtruck to be uſed in another arch before the hanches are filled up. The whole theory of the *piers* may be ſeen in the third ſection of Profeſſor Hutton's *Principles of Bridges*.

They ſhould be made with a broad bottom on the foundation, and gradually diminiſhing in thickneſs by off-ſets up to low-water mark.

Piles, are timbers driven into the bed of the river for various purpoſes, and are either round, ſquare, or flat like planks. They may be of any wood which will not rot under water; but oak and fir are moſtly uſed, eſpecially the latter, on account of its length, ſtraightneſs, and cheapneſs. They are ſhod with a pointed iron at the bottom, the better to penetrate into the ground, and are bound with a ſtrong iron-band or ring at top, to prevent them from being ſplit by the violent ſtrokes of the ram by which they are driven down.

Piles are either uſed to build the foundations on, or they are driven about the pier as a border of defence, or to ſupport the centres on; and in this caſe, when the centering is removed, they muſt either be drawn up, or ſawed off very low under water; but it is perhaps better to ſaw them off and leave them ſticking in the bottom, leſt the drawing of them out ſhould looſen the ground about the foundation of the pier. Thoſe to build on, are either ſuch as are cut off by the bottom of the water, or rather a few feet within the bed of the river; or elſe ſuch as are cut off at low-water mark, and then they are called ſtilts. Thoſe to form borders of defence, are rows driven in cloſe by the frame of a foundation, to keep it firm, or elſe they are to form a caſe or jettée about the ſtilts, to keep the ſtones within it, that are thrown in to fill it up: in this caſe the *piles* are grooved, driven at a little diſtance from each other, and *plank-piles* let into the grooves between them, and driven down alſo, 'till the whole ſpace is ſurrounded. Beſides uſing this for ſtilts, it is ſometimes neceſſary to ſurround a ſtone pier with a ſterling, or jettée, and fill it up with ſtones to ſecure an injured pier from being ſtill more damaged, and the whole bridge ruined. The *piles* to ſupport the centres may alſo ſerve as a border of piling to ſecure the foundation, cutting them off low enough after the centre is removed.

Pile-driver, an engine for driving down the piles. It conſiſts of a large ram or iron ſliding perpendicularly down between two guide-poſts; which being lifted up to the top of them, and there let fall from a great height, comes down upon the top of the pile with a violent blow. It is worked either with men or horſes, and either with or without wheel-work. That which was uſed at the building of Weſtminſter bridge, is perhaps the beſt ever invented.

Pitch, of an arch, the perpendicular height from the ſpring or impoſt to the key-ſtone.

Plan, of any part, as of the foundations, or piers, or ſuperſtructure, is the orthographic projection of it on a plane parallel to the horizon.

Puſh, of an arch. See *Drift*.

Salient angle, of a pier, the projection of the end againſt the ſtream, to divide it. The right-lined angle beſt divides the ſtream, and the more acute, the better for that purpoſe; but the right angle is generally uſed, as making the beſt maſonry. A ſemicircular end, though it does not divide the ſtream ſo well, is ſometimes better in large navigable rivers, as it carries the craft the better off, or bears their ſhocks the better.

Shoot, of an arch. See *Drift*.

Springers, are the first or lowest stones of an arch, being those at its feet, bearing immediately on the impost.

Sterlings, or *Jettées*, a kind of case made about a pier of stilts, &c. to secure it, and is particularly described under the next word, *Stilts*.

Stilts, a set of piles driven into the space intended for the pier, whose tops being sawed level off, above low-water mark, the pier is then raised on them. This method was formerly used when the bottom of the river could not be laid dry; and the e *stilts* were surrounded, at a few feet distance, by a row of piles and planks, &c. close to them like a coffer-dam, and called a *sterling*, or *jettée*; after which loose stones, &c. are thrown or poured down into the space, 'till it is filled up to the top, by that means forming a kind of pier of rubble or loose work, and which is kept together by the sides or sterlings: this is then paved level at the top, and the arches turned upon it. This method was formerly much used, for most of the large old bridges in England being erected that way, such as London bridge, Newcastle bridge, Rochester bridge, &c. But the inconveniences attending it are so great, that it is now quite disused: for, because of the loose composition of the piers, they must be made very large or broad, or else the arch must push them over, and rush down as soon as the centre was drawn; which great breadth of piers and sterlings so much contracts the passage of the water, as not only very much incommodes the navigation through the arch, from the fall and quick motion of the water; but from the same cause also the bridge itself is in much danger, especially in time of floods, when the water is too much for the passage. Add to this, that besides the danger there is of the pier bursting out the sterlings, they are also subject to much decay and damage by the velocity of the water and the craft passing through the arches.

Thrust. See *Drift*.

Voussoirs, the stones which immediately form the arch, their undersides constituting the intrados. The middle one, or key-stone, should be about 1-15th or 1-16th of the span, as has been observed; and the rest should increase in size all the way down to the impost: the more they increase the better, as they will the better bear the great weight which rests upon them without being crushed; and also will bind the firmer together. Their joints should also be cut perpendicular to the curve of the intrados. For more information see Professor Hutton's *Principles of Bridges*, Newcastle, 1772, in 8°.

* BRIGANDINE, in *ancient military history*, a coat of mail, or kind of ancient defensive armour, consisting of tin.

BUCKLER, in *antiquity*, a piece of defensive armour used by the ancients. It was always worn on the left arm, and composed of wicker-work, of the lightest sort, but most commonly of hides, fortified with plates of brass or other metals. The shape of it varied considerably, being sometimes round, sometimes oval, and often nearly square.

BUDGE-*barrels*. See BARRELS, in the first Alphabet.

BUFF. See BELTS, in the first Alphabet.

* BUILDING, in a *general sense*, a fabric erected by art, either for devotion, magnificence, or conveniency.

Military BUILDINGS, are of various sorts, viz. powder-magazines, bridges, gates, barracks, hospitals, store-houses, guard-rooms, &c.

Regular BUILDING, is that whose plan is square, the opposite sides equal, and all the parts disposed with symmetry.

Irregular BUILDING, that whose plan is not contained within equal or parallel lines, either by the accident of situation, or the design of the builder, and whose parts are not relative to one another in the elevation.

Insulated BUILDING, that which is not contiguous to any other, but is encompassed with streets, open squares, or the like.

Engaged BUILDING, one surrounded with other buildings, having no front to any street or public place, nor any communication without, but by a common passage.

Interred or *sunk* BUILDING, one whose area is below the surface of the place where it stands, and of which the lowest courses of stone are concealed.

In *building* there are three things to be considered, viz. first, commodity or conveniency; secondly, firmness or stability; thirdly, delight.

To accomplish which ends, Sir Henry Wotton considers the whole subject under two heads, namely, the seat or situation, and the work.

1. As for the seat, either that of the whole is to be considered, or that of its parts.

2. As to the situation, regard is to be had to the quality, temperature, and salubrity or healthiness of the air; that it be a good healthy air, not subject to foggy noisomeness from adjacent fens or marshes; also free from noxious mineral exhalations; nor should the place want

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the ſweet influence of the ſun-beams, nor be wholly deſtitute of the breezes of wind, which will fan and purge the air; the want of which would render it like a ſtagnated pool, and would be very unhealthy.

In the foundations of *buildings*, Vitruvius orders the ground to be dug up, to examine its firmneſs; that an appearing ſolidity is not to be truſted, unleſs the whole mould cut through be found and ſolid: 'tis true, he does not ſay to what depth it ſhould be dug; but Palladio determines it to be a ſixth part of the height of the building.

The great laws of walling are, 1. That the walls ſtand perpendicular on the ground-work, the right angle being the foundation of all ſtability. 2. That the largeſt and heavieſt materials be the loweſt, as more proper to ſuſtain others than be ſuſtained themſelves. 3. That the work diminiſh in thickneſs, as it riſes, both for the eaſe of weight and expence. 4. That certain courſes, or ledges, of more ſtrength than the reſt, be interlaid, like bones, to ſuſtain the wall from total ruin, if ſome of the under parts chance to decay. 5. Laſtly, that the angles be firmly bound, they being the nerves of the whole fabric; which are ſometimes fortified on each ſide the corners, even in brick buildings, with ſquare ſtones; which add both beauty and ſtrength. See STONE, BRICKS, LIME, SAND.

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*CÆMENT, } *among engineers*, a ſtrong ſort
CEMENT, } of mortar, uſed to bind bricks or ſtones together for ſome kind of mouldings; or in cementing a block of bricks for the carving of capitals, ſcrolls, or the like. There are two ſorts, i. e. hot *cement*, which is the moſt common, made of reſin, bees-wax, brick-duſt, and chalk, boiled together. The bricks to be cemented with this mixture, muſt be made hot in the fire, and rubbed to and fro after the *cement* is ſpread, in the ſame manner as joiners do when they glue two boards together. Cold *cement*, made of Cheſhire cheeſe, milk, quick lime, and whites of eggs. This *cement* is leſs uſed than the former, and is accounted a ſecret known but to very few bricklayers.

*CÆSTUS, in *military antiquity*, a kind of large gauntlet, compoſed of raw hides, uſed by wreſtlers at the public games.

CAIMACAN, in *military hiſtory*, an officer among the Turks, nearly anſwering to our lieutenant.

CAMP. See the firſt Alphabet.

The arrangement of the tents in *camp*, is nearly the ſame all over Europe, which is, to diſpoſe them in ſuch a manner, that the troops may form with ſafety and expedition.

To anſwer this end, the troops are encamped in the ſame order as that in which they are to engage, which is by battalions and ſquadrons; hence, the poſt of each battalion and ſquadron in the line of battle, muſt neceſſarily be at the head of its own encampment. Guſtavus Adolphus, king of Sweden, was the firſt who formed encampments according to the order of battle.

By this diſpoſition, the extent of the *camp* from right to left, of each battalion and ſquadron, will be equal to the front of each in line of battle; and conſequently, the extent from right to left of the whole *camp*, ſhould be equal to the front of the whole army when drawn up in line of battle, with the ſame intervals between the ſeveral encampments of the battalions and ſquadrons, as are in the line.

There is no fixed rule for the intervals: ſome will have no intervals, ſome ſmall ones, and others are for intervals equal to the front of the battalion or ſquadron. The moſt general method is, an interval of 60 feet between each battalion, and of 36 feet between each ſquadron.

Hence it follows, 1ſt, That the front line of the *camp* be in a direction to face the enemy; 2dly, That at the head of the encampment of each battalion and ſquadron, there muſt be a clear ſpace of ground, on which they may form in line of battle; and 3dly, That when the ſpace taken up by the army is embarraſſed with woods, ditches, and other obſtructions, a communication muſt be opened for the troops to move with eaſe to the aſſiſtance of each other.

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The *camps* of the Greeks and Romans were either round, ſquare, or oval, or rather of an oblong ſquare, with the ſharp corners taken off; and to ſecure them againſt ſurpriſes, it was the prevailing cuſtom to ſurround them with intrenchments. The *camps* of the Anglo-Saxons and Danes were generally round, as likewiſe thoſe of the Anglo-Normans. The *camps* of the ancient Britons were of an oval form, compoſed of ſtakes, earth, and ſtones, rudely heaped together: but the practice of the preſent times is quite different; for the ſecurity of our *camps*, whoſe form is a rectangle, conſiſts in being able to draw out the troops with eaſe and expedition at the head of their reſpective encampments.

Camp *of a battalion of infantry*, is the ground on which they pitch their tents and lodges.

The principal object in the arrangement of a *camp* is, that both officers and men may repair with facility and expedition to the head of the line; for which reaſon the tents are placed in rows perpendicular to the front of the camp, with ſpaces between them, called ſtreets. The general method is, to form as many rows of tents as there are companies in the battalion; thoſe for the private men in the front, and thoſe for the officers in the rear. See Pl. VIII.

The ſeveral companies of a battalion are poſted in camp, in the ſame manner as in the line of battle; that is, the company of grenadiers on the right, and that of light-infantry on the left; the colonel's company on the left of the grenadiers, the lieutenant-colonel's on the right of the light-infantry, the major's on the left of the colonel's, the eldeſt captain's on the right of the lieutenant-colonel's; and ſo on from right to left, 'till the two youngeſt companies come into the centre.

The battalion companies are poſted two by two; that is, the tents of every two of theſe companies are ranged cloſe together, to obtain, though fewer, larger and more commodious ſtreets: the entrances of all the companies tents face the ſtreets, except the firſt tent of each row belonging to the ſerjeants, which faces the bells of arms and front of the camp.

The number of tents in each perpendicular row, is regulated by the ſtrength of the companies, and the number of men allowed to each tent, which at preſent is 5 men: thence it follows, that a company of 60 men will require 12 tents, a company of 75 men 15 tents, and a company of 100 men 20 tents; but as it always happens that ſome are on duty, fewer tents may ſerve in time of neceſſity.

When the battalion is in the firſt line of encampment, the privies are opened in the front, and at leaſt 150 feet beyond the quarter-guard; and when in the ſecond line, they are opened in the rear of that line.

To diſtinguiſh the regiments, camp colours are fixed at the flanks, and at the quarter and rear guard.

The colours and drums of each battalion are placed at the head of its own grand ſtreet, in a line with the bells of arms of the ſeveral companies. The officers eſpontoons are placed at the colours, with the broad part of their ſpears to the front. The ſerjeants halberts are placed between, and on each ſide of the bells of arms, with their hatchets turned from the colours.

When two field-pieces are allowed to each battalion, they are poſted to the right of it. Guſtavus Adolphus, king of Sweden, was the firſt who ordered two field-pieces to each battalion, which are generally light 6-pounders.

Diſtribution of the front and depth of the Camp *for a battalion of infantry.* The preſent mode of encampments differs from what they formerly were. The front of the *camp* for a battalion of 10 companies of 60 men each, is at preſent 400 feet, and during the late wars only 360 feet; the depth at preſent 759 feet, and during the late war 960. The front of the *camp* of a battalion of 10 companies of 100 men each is at preſent 668 feet, and formerly only 592; the depth 759 feet, formerly 960. The breadth of the ſtreets from 45 to 55 feet, excepting the main ſtreet, which is ſometimes from 60 to 90 feet broad.

Of the Camp *of a battalion by a new method.* This is, by placing the tents in 3 rows parallel to the principal front of the *camp*; that is, ſuitable to the 3 ranks in which the battalion is drawn up: the tents of the firſt row, which front the *camp*, are for the men of the front rank: the tents of the ſecond row front the rear, and are for the men of the ſecond rank; and the tents of the third row, which front the centre row, are for the men of the rear rank.

Camp *of cavalry.* The tents for the cavalry, as well as for the infantry, are placed in rows perpendicular to the principal front of the *camp*; and their number is conformable to the number of troops. The horſes of each troop are placed in a line parallel to the tents, with their heads towards them. See Pl. IX.

The number of tents in each row, is regulated by the ſtrength of the troops, and the number of troopers allotted to each tent is 5: it follows that a troop of 30 men will require 6 tents, a troop of 60 men 12 tents, and a troop

troop of 100 men 20 tents. The tents for the cavalry are of the ſame form as thoſe of the infantry, but more ſpacious, the better to contain the fire-arms, accoutrements, ſaddles, bridles, boots, &c. See TENTS.

Diſtribution of the front and depth of a CAMP *of cavalry.* Suppoſing the regiment to conſiſt of 2 ſquadrons, of 3 troops each, and of 50 men in each troop, the extent of the front will be 450 feet, if drawn up in 2 ranks; but if drawn up in 3 ranks, the front will be only 300 feet, the depth 220, and the breadth of the back ſtreets 30 feet, and the other ſtreets 46 feet each. In the laſt war 600 feet were allowed each regiment of cavalry in front, 774 feet for the depth, and the breadth of the ſtreets as above.

The ſtandard-guard tents are pitched in the centre, in a line with the quarter-maſter's. The camp colours of the cavalry are alſo of the ſame colour as the facing of the regiment, with the rank of the regiment in the centre: thoſe of the horſe are ſquare, like thoſe of the foot; and thoſe of the dragoons are ſwallow-tailed. The dung of each troop is laid up behind the horſes. See Pl. IX.

CAMP *duty*, conſiſts in guards, both ordinary and extraordinary: the ordinary guards are relieved regularly at a certain hour every day (generally about 9 or 10 o'clock in the morning); the extraordinary guards are all kinds of detachments commanded on particular occaſions for the further ſecurity of the *camp*, for covering the foragers, for convoys, eſcorts, or expeditions.

The ordinary guards are diſtinguiſhed into grand guards, ſtandard, and quarter guards; rear guards, picket guards, and guards for the general officers; train of artillery, bread waggons, pay-maſter general, quarter-maſter general, majors of brigade, judge advocate, and provoſt marſhal. See GUARDS, in the firſt Alphabet.

The number and ſtrength of the grand guards and out-poſts, whether of cavalry or infantry, depend on the ſituation of the *camp*, nature of the country, and the poſition of the enemy. The ſtrength of general officers guards is limited. See HONOURS, in the firſt Alphabet.

CAMP *maxims*, are, 1. The principal rule in forming a *camp*, is to give it the ſame front the troops occupy in order of battle.

2. The method of encamping is by battalions and ſquadrons, except the royal regiment of artillery, which is encamped on the right and left of the park of artillery. See ARTILLERY PARK, and *Encampment of a regiment of artillery*, in the firſt Alphabet.

3. Each man is allowed 2 feet in the ranks of the battalion, and 3 feet in the ſquadron: thence the front of a battalion of 900 men, formed 3 deep, will be 600 feet; and the front of a ſquadron of 150 men, formed 2 deep, will be 225 feet.

4. The depth of the *camp* when the army is encamped in 3 lines, is at leaſt 2750 feet; that is, 750 feet for the depth of each line, and 250 feet for the ſpace between each of thoſe lines.

5. The park of artillery ſhould always be placed on a dry riſing ground, if any ſuch ſituation offers; either in the centre of the front line, or in the rear of the ſecond line; with all the train horſes encamped in the rear of the park. See Pl. II.

6. The bread-waggons ſhould be ſtationed in the rear of the *camp*, and as near as poſſible to the centre, that the diſtribution of the bread may be rendered eaſy.

7. When the commander in chief encamps, it is generally in the centre of the army; and the town or village choſen for his reſidence is called head quarters.

8. That general is inexcuſable, who, for his own perſonal accommodation, makes choice of quarters that are not properly ſecured, or at too great a diſtance to have an eaſy communication with the *camp*.

9. If the ground permits, the troops ſhould be encamped as near to good water as poſſible.

10. When there are huſſars, they are generally poſted near the head quarters, or in the front of the army.

11. The ground taken up by the encampment of an army, ſhould be equally diſtributed, and, if poſſible, in a ſtraight line; for then the whole will have more grace: for a crooked line, and an inequality of diſpoſition, afford a very unpleaſing view both of the camp, and of the troops when they are under arms.

12. Cleanlineſs is eſſentially neceſſary to the health of a *camp*, eſpecially when it is to remain for any length of time. To maintain this, the privies ſhould be often filled up, and others opened; at leaſt every 6 days. The offal of cattle, and the carcaſſes of dead horſes, ſhould be buried very deep; and all kinds of corrupt effluvia, that may infect the air and produce epidemical diſorders, ſhould be conſtantly removed.

Choice of CAMPS. 1. At the beginning of a

a campaign, when the enemy is at too great a diſtance to occaſion any alarm, all ſituations for *camps* that are healthy are good, provided the troops have room, and within reach of water, wood, and proviſions. More ground ſhould be allowed to the troops in *camps* of duration, than in temporary ones.

2. *Camps* ſhould be ſituated as near as poſſible to navigable rivers, to facilitate the conveyance of all manner of ſupplies; for convenience and ſafety are the principal objects for *camps*.

3. A *camp* ſhould never be placed too near heights, from whence the enemy may overlook it; nor too near woods, from whence the enemy may ſurpriſe it. If there are eminences, not commanded by others, they ſhould be taken into the *camp*; and when that cannot be done, they ſhould be fortified.

4. The choice of a *camp* depends in a great meaſure on the poſition of the enemy, on its ſtrength, and on the nature and ſituation of the country.

5. A ſkilful general will avail himſelf of all the advantages for a *camp*, which nature may preſent, whether in plains, mountains, ravins, hollows, woods, lakes, incloſures, rivers, rivulets, &c.

6. The diſpoſition of the troops in *camp* ſhould depend on the nature and ſituation of the ground; as there are occaſions which require all the infantry to encamp on the right, and the cavalry on the left; and there are others which require the cavalry to form in the centre, and the infantry on the wings.

7. A *camp* ſhould never be formed on the banks of a river, without a ſpace of at leaſt 2 or 3000 feet, for drawing out the army in order of battle: the enemy cannot then eaſily alarm the *camp*, by artillery and ſmall arms from the other ſide.

8. *Camps* ſhould never be ſituated near rivers that are ſubject to be overflowed, either by the melting of the ſnow, or by accidental torrents from the mountains. Marſhy grounds ſhould alſo be avoided, on account of the vapours ariſing from ſtagnant water, which infect the air.

9. On the choice of *camps* and poſts, frequently depends the ſucceſs of a campaign, and even ſometimes of a war.

CAMP *guards*. They are of two ſorts; the one ſerve to maintain good order within the *camp*; and the other, which are ſtationed without the *camp*, ſerve to cover and ſecure it againſt the enemy. Theſe guards are formed of both infantry and cavalry; and in proportion to the ſtrength of the army, ſituation of the *camp*, and diſpoſition of the enemy, ſome require that theſe guards ſhould conſiſt of the 8th part of the army; others, of the 3d part; and when an attack from the enemy is apprehended, even of the half.

Manner of ſtationing the CAMP *guards*. It is of the utmoſt conſequence to ſtation the guards in ſuch places, as may enable them to diſcover eaſily whatever approaches the *camp*.

2. The guards of the cavalry are generally removed further from the *camp*, than thoſe of the infantry; but never at ſo great a diſtance, as to endanger their being cut off: within cannon-ſhot is a very good diſtance. They are often ſtationed in highways, in open places, and on ſmall heights; but, however, ſo diſpoſed, as to ſee and communicate with one another.

3. The vedettes to the out-poſts ſhould be double; for, ſhould they make a diſcovery, one may be detached to inform the officer commanding the out-poſt, and the other remain on duty: they ſhould not be at too great a diſtance from their detachment; probably, about 50 or 60 paces is enough.

4. The guards of infantry have different objects, and are differently ſtationed: their duty is, to receive and ſupport the guards of cavalry in caſe of need; to protect the troops ſent out for wood, forage, or water; in ſhort, to prevent any approaches from the ſmall parties of the enemy. Some are ſtationed in the churches of the neighbouring villages, in caſtles, houſes, and in paſſages and avenues of woods; others are ſtationed on the borders of rivulets, and in every place neceſſary to ſecure the *camp*. Guards that are ſtationed in churches, ſteeples, trees, caſtles, and houſes, ſhould if poſſible be ſeen from the army, or at leaſt from ſome grand guard in its neighbourhood, that ſignals may be ſeen and repeated.

5. The guards of infantry are generally fixed; that is, they have the ſame poſt both day and night, except ſuch as are to ſupport and protect the guards of cavalry, and to cover the forage grounds. All out-guards ſhould have intrenching-tools with them.

6. The guards of cavalry have generally a day poſt and a night poſt; the latter is ſeldom more than 4 or 500 paces from the *camp*; one third ſhould be mounted, one third bridled, and one third feeding their horſes; but when near the enemy, the whole guard ſhould be kept mounted during the night.

7. The ſecurity and tranquillity of a *camp* depending upon the vigilance of the guards, the officers who command them cannot be too active in preventing ſurpriſes: a neglect in this particular is often of fatal conſequence. Though an officer ſhould, at all times, be ſtrictly attentive to every part of the ſervice, yet he ſhould be more particularly watchful in the night than in the day. The night is the time moſt favourable for ſurpriſes; as thoſe who are not on duty, are generally aſleep, and cannot immediately afford aſſiſtance; but in the day time, the attention of all the troops is turned to the movements of the enemy; they are ſooner under arms, ſooner in readineſs to march, and in much leſs danger of being thrown into confuſion.. Thoſe who wiſh to be better acquainted with the nature and mode of encampments, may read Mr. Lochée's uſeful *Eſſay on Caſtrametation.* *

Concerning the healthineſs of the different ſeaſons of a campaign, the ingenious Dr. Pringle has the following obſervations. The firſt 3 weeks is always ſickly; after which the ſickneſs decreaſes, and the men enjoy a tolerable degree of health throughout the ſummer, unleſs they get wet clothes. The moſt ſickly part of the campaign is towards the end of Auguſt, whilſt the days are ſtill hot, but the nights cold and damp with fogs and dews; then, if not ſooner, the dyſentery prevails; and though its violence is over by the beginning of October, yet the remitting fever, gaining ground, continues throughout the reſt of the campaign, and never entirely ceaſes, even in winter quarters, 'till the froſt begins. He likewiſe obſerves, that the laſt 14 days of a campaign, if protracted 'till the beginning of November, is attended with more ſickneſs than the two firſt months of the encampment. As to winter expeditions, though ſevere in appearance, he tells us, they are attended with little ſickneſs, if the men have ſtrong and good ſhoes, warm quarters, fuel, and proviſions enough.

CANNONADE, in *artillery*, may be defined the application of artillery to the purpoſes of a land war, or the direction of its efforts againſt ſome diſtant object intended to be ſeized or deſtroyed, as the troops in battle, battery, fortreſs, or out-work.

Cannonading is therefore uſed from a battery, to take, deſtroy, burn, or drive the enemy from the defences, &c. and to batter and ruin the works or fortified towns.

CANNON. See this word in the firſt Alphabet.

Dimenſions of all ſorts of braſs CANNON, *as eſtabliſhed by the board of ordnance in* 1764.

Nature		Pders.	Length F.	in.	Weight C.	q.	lb.	Calibre of the gun in. hun.	Diam. of the ſhot in. hun.
Braſs guns	Heavy	42	9	6	61	0	0	7.3	6.68
		24	9	6	52	0	0	5.83	5.54
		12	9	0	29	0	0	4.63	4.40
		9	9	0	26	0	0	4.21	4.0
		6	8	0	19	0	0	3.66	3.48
		3	7	0	11	2	0	2.91	2.77
		1½	6	0	5	2	0	2.31	2.20
	Mediums	24	8	0	40	1	21	5.83	5.54
		12	6	6	21	0	14	4.63	4.40
		6	5	0	10	1	0	3.66	3.48
	Light	24	5	6	16	1	12	5.83	5.54
		12	5	0	8	3	18	4.63	4.40
		6	4	6	4	3	14	3.66	3.48
		3	3	6	2	3	4	2.91	2.77

* This gentleman keeps a military academy at Little Chelſea, where youth are well inſtructed in the military ſciences and diſcipline, requiſite for the infantry and cavalry. He is deſervedly patroniſed by his Majeſty, and his mode of education has met with the approbation of the moſt ſkilful officers.

Dimensions of all sorts of iron CANNON, *established*, 1764.

Nature	Pdrs.	Length F.	Length in.	Weight C.	Weight q.	Weight lb.	Calibre of the gun in. hun.	Diam. of the shot in. hun.
Iron guns	42	9	6	65	0	0	7.3	6.68
	32	9	6	55	0	0	6.42	6.10
	24	9	6	49	0	0	5.83	5.54
	24	9	6	47	2	0	5.83	5.54
	18	9	0	40	0	0	5.29	5.3
	12	9	0	32	2	0	4.63	4.40
	12	8	6	31	2	0	4.63	4.40
	12	7	6	29	1	0	4.63	4.40
	9	9	0	29	0	0	4.21	4.0
	9	8	6	27	2	0	4.21	4.0
	9	8	0	26	2	0	4.21	4.0
	9	7	6	24	2	0	4.21	4.0
	9	7	0	23	0	0	4.21	4.0
	6	9	0	24	0	0	3.66	3.48
	6	8	6	23	0	0	3.66	3.48
	6	8	0	22	0	0	3.66	3.48
	6	7	6	20	2	0	3.66	3.48
	6	7	0	19	0	0	3.66	3.48
	6	6	6	18	0	0	3.66	3.48
	6	6	0	16	2	0	3.66	3.48
	4	6	0	12	1	0	3.21	3.4
	4	5	6	11	1	0	3.21	3.4
	3	4	6	7	1	0	2.91	2.77
	½	3	0	1	1	25	1.58	1.52

To lay a CANNON *to a given object.* First find the centre of metal by the perpendicular, then apply your two fore fingers to the base centre, and look behind them until you make the muzzle centre cut the centre of the object; then the piece is properly directed. Secondly, having determined upon the necessary elevation, place the centre of the quadrant in the bore, and elevate or depress the piece 'till the plummet cuts the required elevation; and the piece is laid.

When the object fired at cannot be seen from the battery, which is often the case with mortars, proceed thus for the direction. Ascend the nearest ground in a line between the battery and object, from whence you can see them both, and place 2 pickets in such a direction as to cut each mortar and the object it is to be fired at; then make the centres of metal of each mortar cut its proper picket, and it will be properly laid.

CARCASSES. See the first Alphabet.

COMPOSITION for each nature of CARCASSES.

Corned powder 30 lb. Swedish pitch 12 lb. salt-petre 6 lb. and tallow 3 lb. The corned powder and salt-petre to be well mixed together; the pitch and tallow to be made hot over the fire, and put into another pan; then mixed with the corned powder and salt-petre; and lastly, mix them well together for use. When old, they are to be primed with fuze composition.

Weight of new oblong hammered CARCASSES, *established the 22d of April*, 1759.

Diam.	When empty lb.	When empty oz.	Coated lb.	Coated oz.	Filled lb.	Filled oz.	Woulded lb.	Woulded oz.	Primed lb.	Primed oz.	Kitted lb.	Kitted oz.
10-inch	33	0	33	10	64	14	69	8	70	4	71	2
8-inch	15	12	16	1	32	14	33	2	33	10	34	0
5½-in.	1	8	1	10	8	6			8	9	8	12
4⅖-in.	1	2	1	4	4	9			4	10	4	12

Dimensions and weight of round Carcasses, *as established the 2d of August*, 1760.

	Diameter of the carcass		Diameter of the holes				Distance of each hole		Thickness of metal		
			The top hole		In the sides						
Natures	Exterior	Interior	at top	at bottom	at top	at bottom	From the top hole	In the sides one fr. anoth.	Of each of the holes	At the bot. of the carcass	Weight
	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	c. q. lb.
5 holes	12.75	8.20	3.40	$3.\frac{1}{4}$	2.40	$2.\frac{3}{10}$	6.20	7.0	2.0	2.55	1 2 14
4 holes	12.75	8.0	3.50	3.30	2.50	2.20	6.20	10.85	2.0	3.0	1 2 26
3 holes	12.75	7.50	4.0	3.80	2.80	2.60	6.20	12.0	2.0	3.25	1 3 4

* CAR, in *military antiquity*, a kind of small carriage; figuratively, used by the poets for a chariot: it is mounted on wheels, representing a stately throne, used in triumphs and on other solemn occasions.

* CARIPI, in *military history*, a kind of cavalry in the Turkish army, which to the number of 1000 are not slaves, nor bred up in the seraglio, like the rest, but are generally Moors, or renegado Christians, arrived to the rank of horse-guards to the Grand Signior.

CARTOUCHES, in *artillery*, are made of leather, to sling over the shoulder of the matross, who therein carries the ammunition from the magazine or waggon, for the service of the artillery, when at exercise or on real service.

* CASTRAMETATION, in the *art of war*, is the art of measuring or tracing out the form of a camp on the ground; yet it sometimes has a more extensive signification, by including all the views and designs of a general; the one requires only a mathematician, the other an experienced soldier. The ancients were accustomed to fortify their camps by throwing up intrenchments round them. The Turks, and other Asiatic nations, fortify themselves, when in an open country, with their waggons and other carriages. The practice of the Europeans is quite different; for the surety of their camp consists in the facility and convenience of drawing out their troops at the head of their encampment; for which reason, whatever particular order of battle is regarded as the best disposition for fighting, it follows of course, that we should encamp in such a manner as to assemble and parade our troops in that order and disposition as soon as possible. It is therefore the order of battle that should regulate the order of encampment; that is to say, the post of each regiment in the line of battle should be at the head of its own encampment; from whence it follows, that the extent of the line of battle from right to left of the camp, should be equal to the front of the troops in line of battle, with the same intervals in the camp as in the line. By this means every battalion covers its own tents, and they can all lodge themselves, or turn out in case of necessity, at a minute's warning.

If the front of the camp is greater than the line, the troops must leave large intervals, or expose their flanks; if less, the troops will not have room to form with the proper intervals.

The front or principal line of the camp is commonly directed to face the enemy. See Camp, in the first, and this Alphabet.

* CENTESTIMATION, in *ancient military history*, a mild kind of military punishment, in cases of desertion, mutiny, and the like, when only every 100th man is executed.

* CIRCLE, in *mathematics*, is a plane figure, comprehended under one line only, to which all right lines, drawn from a point in the middle of it, are equal to one another.

The angle BAC (Pl. XVI. *fig.* 1.) made by the tangent AB, and the chord AC, is equal to any angle AEC, or ADC, in the alternate segment AEC of the *circle*.

Let $ACDE$ be a quadrilateral figure in the *circle*, and the lines AD, EC, the diagonals, then $AC \times ED + AE \times CD = AD \times CE$.

In a *circle* the sine of any arch is equal to half the chord of twice that arch. The square of

the chord of any arch is equal to the rectangle under the versed fine of that arch, and the diameter of the *circle*. The fine of an arch is to the cofine thereof, as the radius is to the tangent of that arch. The radius is a mean proportional between the fine of an arch and the cofecant of that arch. The radius is a mean proportional between the tangent of an arch and its cotangent. As the radius is to a mean proportional between the aggregate of the radius and fine of the arch, and the difference between the radius and that fine; fo is twice that fine to the fine of double that arch.

In a femi-circle, if AB (*fig.* 4.) be the chord of an arch, and FD the chord of ½ the complement of that arch to a femi-circle; then will the difference between the diameter AD and the chord AB, the chord FD, and the radius AC, be continual proportionals.

The method of finding the circumference of a *circle* from its diameter, or radius, being given, is one of the moft ufeful problems in geometry. The ancient method of folving this noble propofition, was to find continually the fine of half the arch, which was performed in the following manner: the fine LP being given, the cofine OP, and verfed fine PN (*fig.* 5.) may be eafily found; but $LNq = LPq + PNq$.

Wherefore $\sqrt{LPq + PNq} = LN = 2\,LQ$. Therefore $\frac{1}{2} LN = QN = LQ$. Now as the fine of 30° = half the radius, the fine of 15° is had by the foregoing equation; and by repeating the operation, the fine 7° 10′ may be found; and fo on continually, 'till the fine of the arch laft found, its tangent, and confequently, the arch itfelf is expreffed by the fame decimal part of the radius. But as this method was attended with frequent involutions, and extractions of roots of very large numbers, the greateft mathematicians have endeavoured to find fhorter and eafier methods of obtaining the *circle*'s periphery. The moft direct and eafy method is by the help of the infinite feries.

Let C be the centre of a *circle* (*fig.* 3.) $CB = CA = 1$, the radius, $AB = x$ any arch, therefore, $AD = y$, its right fine then will be CD, its cofine $= \sqrt{1 - yy}$.

Let CE be another radius of the *circle* infinitely near to CA, then will $EG = \dot{y}$ be the fluxion of the fine AD, and the infinitely fmall arch $EA = \dot{x}$, the fluxion of the arch AB. And from the fimilarity of the triangles CAD and EAG, it will be as $CD : CA ::$ $EG : EA$; that is, in fpecies $\sqrt{1 - yy} : 1 :: \dot{y} : \dot{x}$. This expanded into a feries, and multiplied by $\dot{y}$, its fluent will be $y + \frac{y^3}{6} + \frac{3y^5}{40} + \frac{5y^7}{112} + \frac{35y^9}{1152} + \frac{63y^{11}}{2816}$, &c. the length of the arch AB. Hence the length of any fine or ordinate in the *circle* being given, the correfponding arch may be eafily found. If therefore the diameter of the circle be equal to 1. the circumference will be 3. 1415, 9265, 354 +.

The impoffibility of expreffing the exact proportion of the diameter of a *circle* to its circumference, by any received way of notation; and the abfolute neceffity of having it as near a quadrature as poffible, has put fome of the moft celebrated men in all ages upon endeavouring to approximate as near as may be to the truth. The firft who attempted it with fuccefs, was the elaborate Van Ceulen, a Dutchman, who by the ancient method, though fo very laborious, carried it to 36 decimal places. The indefatigable Mr. Sharp carried it to 72 decimal places; and fince that Mr. Machin has carried it to 100 places; and it is as follows. If the diameter of the *circle* be 1, the circumference will be 3. 14159, 26535, 89793, 23846, 26433, 83279, 50288, 41971, 69399, 37510, 58209, 74944, 59230, 78164, 05286, 20899, 86280, 34825, 34211, 70679, +, of the fame parts; which is a degree of exactnefs far furpaffing all imagination.

But the ratio's generally ufed in practice are as 7 to 22; as 106 to 333; 113 to 355; as 1702 to 5347; as 1815 to 5702; or as 1 to 3. 14159.

Since, when the diameter of a *circle* is 1, the circumference will be 3. 14159, 26536— of the fame parts; and fince all *circles* are fimilar figures, it will be,

1. As 1, to 3. 14159, 26536—, fo is the diamether of a *circle* to its circumference. Wherefore, if the diameter of any *circle* be multiplied by 3. 14159, 26536—, the product will be the length of the circumference in the fame parts.

2. As 3. 14159, 26536— to 1, or as 1 to .31830, 98862—, fo is the circumference of a *circle* to its diameter. Wherefore, if the circumferenee of any *circle* be divided by 3.14159, 26536—, or multiplied by its reciprocal .31830, 98862—, the former quotient, or the latter product, will give the diameter.

3. In the *circle* $BEGH$ (*fig.* 2.) put $BG = d$, or $OG = r$, then will $d = 2r$. Let A ftand for the area, and c for the circumference, and fuppofe the arch $FG = x$ to be infinitely fmall, then

then will $\frac{r\dot{x}}{2}$ be the area of the infinitely ſmall ſector OFG; this, thereſore, multiplied by the whole circumference c, that is, putting c in the room of $\dot{x}$, we ſhall have $\frac{rc}{2} = A$, equal to the centre area of the *circle*.

4. Hence the area of any *circle* is found, by multiplying half the circumference by half the diameter or radius.

5. Hence every *circle* is equal to a triangle, whoſe baſe is equal to the circumference and perpendicular height of the radius.

6. Hence *circles* are to each other, as the ſquares of their reſpective diameters.

7. Hence, as 4 times the diameter to the circumference, ſo is the ſquare of the diameter to the area.

8. Hence *circles* are to each other, as the ſquares of their radii.

9. Hence, as the diameter of a *circle* is to its circumference, ſo is the ſquare of the radius to the area. Wherefore,

As 1, to 3.14159, 26536—, ſo is the ſquare of the radius, to the area of the ſame *circle*.

10. Hence *circles* are to each other as the ſquares of their peripheries or circumferences.

11. Hence, as 4 times the circumference is to the diameter, ſo is the ſquare of the circumference to the area. That is,

As 12.56637, 06144—, to 1, or as 1 to .07957, 74715; ſo is the ſquare of the periphery of any *circle*, to its area. Wherefore, if the ſquare of the periphery be divided by 12.56637, 06144—, or multiplied by .07957, 74715, the former quotient, or the latter product, will give its content.

CIRCLES. See GEOGRAPHY and GEOMETRY, in the firſt Alphabet.

COLOURS, *uſed in the drawings of fortification*. It is neceſſary to uſe *colours* in the drawings of plans and profiles of a fortification, in order to diſtinguiſh every particular part, and ſeparate, as it were, the one from the other, ſo as to make their difference more ſenſible. The different ſorts of *colours*, generally uſed in theſe kinds of drawings, are, *Indian-ink*, *carmine*, *verdigreaſe*, *ſap-green*, *gum-bouch*, *Pruſſian blue*, *indigo*, and *umber*.

Indian-ink, is the firſt and moſt neceſſary thing required in drawing; for it ſerves, in drawing the lines, to expreſs hills or riſing grounds, and, in ſhort, for all what is called ſhading in drawings. The beſt ſort of *Indian-ink* is of a bluiſh black, ſoft, and eaſily reduced into a liquid, free from ſand or gravel. It is ſold in ſticks from ſix-pence a ſtick to half a crown, according to its goodneſs and quantity. That made in Europe is good for nothing.

The manner of liquefying it, is by putting a little clear water into a ſhell or tea-cup, and rubbing it gently 'till the water is black, and of a conſiſtence much like common ink: when it is uſed for drawing lines, it muſt be made very black, though not too thick, otherwiſe it will not eaſily flow out of the drawing-pen; but when it is for ſhading, it muſt be pale, ſo as to go over the ſame ſhade ſeveral times, which adds a beauty to the ſhading.

Carmine, is an impalpable powder, and the faireſt red we know of: it ſerves for colouring the ſections of maſonry, the plans of houſes, and all kinds of military buildings; as likewiſe their elevation: but then it is made of a paler colour. It is alſo uſed for drawing red lines in plans, to repreſent walls. It is exceedingly dear, being generally ſold for a guinea an ounce; but a little will go a great way. It muſt be mixed with a little gum-water.

Verdegreaſe, or *ſea-green*, uſed in drawings, is either liquid in ſmall vials for ſix-pence a piece, or mixed in little pots or ſhells, &c. it ſerves to colour wet ditches, rivers, ſeas, and in general to repreſent all watery places.

Sap-green, is a ſtone of a feint yellowiſh green, when liquefied with clear water; but when mixed with a little ſea-green, it makes a beautiful graſs-green; but, as all mixed *colours* are liable to fade, if *verd'iris* can be had, it will be much better. *Sap-green* is very cheap.

Gum-bouch, is a fine yellow in ſtones, and very cheap. It may be diſſolved in water, but without gum: it ſerves to colour all projects of works; as likewiſe to diſtinguiſh the works unfiniſhed from thoſe that are ſo. It ſerves alſo to colour the trenches of an attack.

Indigo, is in ſmall cakes, and very cheap; it ſerves to colour iron, and roofs of buildings which are covered with ſlates: it muſt be well ground upon a ſmooth ſtone or glaſs, and mixed with a little gum-water.

Pruſſian blue, is a kind of friable ſtone, of an exceeding fine blue: it is uſed to repreſent the colour of blue cloth in drawing encampments, battles, &c. It muſt be well ground, and mixed with a little gum-water.

Smalt, alſo a good ſort of blue, and may be uſed for the ſame purpoſes. It is not dear.

Ultramarine, is an impalpable powder, and of a very delicate ſky-blue. It is a dear *colour*.

Umber, is a yellowiſh brown *colour* in powder: when it is mixed with gum-water, it ſerves

 to

to colour dry ditches, ſand, and all kinds of earth. By mixing a little red ink with it, it will make a wood *colour*.

If ſome tobacco-leaves are ſteeped in clear water for ſeveral hours, and filtered through a woollen cloth, or brown paper, with a little red ink mixed with it, it will make the beſt earth or wood *colour*, as lying ſmoother than any other.

Gum-water, is beſt when it is made ſome time before it is uſed; for which reaſon take ſome *gum arabic* and ſteep it in clear water for ſome hours, 'till it is diſſolved; then ſtrain it through a woollen cloth or brown paper, and preſerve it in phials, well ſtopped, 'till wanted.

COMMAND, in *military matters*. All *commands* fall to the eldeſt in the ſame circumſtance, whether of horſe, dragoons, artillery, foot, or marines. Among the officers of the corps of the Britiſh troops, entire or in parts, in caſe two of the ſame date interfere, a retroſpection of former commiſſions, or length of ſervice, is to be examined and ended by the judgment of the rules of war. See COMMAND, in the firſt Alphabet.

COUNTER *trenches*. See SIEGE.

COUNTER *working*, is the raiſing of works to oppoſe thoſe of the enemy. See COUNTER, &c. in the firſt Alphabet.

CROSS-*bar ſhot*, in *gunnery*, ſhot with iron bars croſſing through them, ſometimes ſtanding 6 or 8 inches out at both ſides: they are uſed at ſea, for deſtroying the enemy's rigging. At a ſiege they are of great ſervice in deſtroying the enemy's paliſading, &c. See SHOT, in the firſt Alphabet.

* CROWNS, in *ancient military hiſtory*, were of various uſes and denominations, viz.

Oval CROWN, *corona ovalis*, given to a general who, without effuſion of blood, had conquered the enemy.

Naval CROWN, *corona navalis*, diſtributed to thoſe who firſt ſhould board an enemy's ſhip.

Camp CROWN, *corona caſtrenſis*, the reward of thoſe who firſt paſſed the paliſades of, and forced an enemy's camp.

Mural CROWN, *corona muralis*, the recompence and mark of honour due to thoſe who firſt mounted the breach at an aſſault of a beſieged town.

Civil CROWN, *corona civica*, more eſteemed than the preceding: it was the diſtinguiſhing mark of thoſe who had ſaved the life of a Roman citizen in battle. It was given to Cicero for diſſipating the conſpiracy of Catiline, and denied to Cæſar, becauſe he imbrued his hands in the blood of his fellow citizens.

Triumphal CROWN, *corona triumphalis*, the ſymbol of victory, and preſented to a general who gained any ſignal advantage to the republic.

Graſs CROWN, *corona graminea*, was delivered by the whole Roman people to any general who had relieved an army inveſted or beſieged by the enemy. The other *crowns* were diſtributed by the emperors and generals; this was given to Fabius by the Roman people, for obliging Hanibal to decamp from Rome.

Olive CROWN, *corona oliva*, the ſymbol of peace, and preſented to the negotiators of it.

CUTTING-*off*. See RETRENCHMENT, in the firſt Alphabet.

D

DECOY, in a *military ſenſe*, is a very diverting ſtratagem to carry off the enemy's horſes in a foraging party, or from the paſture; to execute which, you muſt be diſguiſed, and ſo mix on horſeback in the paſture, or amongſt the foragers on that ſide on which you propoſe to fly: you muſt then begin, by firing a few ſhots, which are to be anſwered by ſuch of your party as are appointed to drive up the rear, and are poſted at the oppoſite extremity of the paſture, or foraging ground; after which they are to gallop from their different ſtations towards the ſide fixed for the flight, ſhouting and firing all the way: the horſes being thus alarmed, and provoked by the example of others, will break looſe from the pickets, throw down their riders and the truſſes, and ſetting up a gallop, will naturally direct their courſe to the ſame ſide; inſomuch that, if the number of them was ever ſo great, you might lead them in that manner for ſeveral leagues together: when you are got into ſome road, bordered by a hedge, or ditch, you muſt ſtop as gently as poſſible, and without making any noiſe, where the horſes will ſuffer themſelves to be taken without any oppoſition. It is called in French *Haraux*; and

Count

Count Saxe is the only author that mentions it.

DODECAGON, in *geometry*, is a regular figure containing 12 equal ſides and angles. If the radius of a circle in which the *dodecagon* is inſcribed be = 1, then the ſide of the *dodecagon* will be nearly .654; and as one is to the ſquare of the ſide of any given *dodecagon*, ſo is 2.51956 to the area of it nearly.

* DODECAHEDRON, is one of the platonic bodies, or five regular ſolids, and is contained under 12 equal and regular pentagons.

The ſolidity of a *dodecahedron* is found by multiplying the area of one of the pentagonal faces of it by 12; and this latter product by 1-3d of the diſtance of the face from the centre of the *dodecahedron*, which is the ſame as the centre of the circumſcribing ſphere.

The ſide of a *dodecahedron* inſcribed in a ſphere, is the greater part of the ſide of a cube inſcribed in that ſphere, cut into extreme and mean proportion.

If the diameter of the ſphere be 1.0000, the ſide of a *dodecahedron* inſcribed in it will be .35682 nearly.

All *dodecahedrons* are ſimilar, and are to one another as the cubes of the ſides; and their ſurfaces are alſo ſimilar, and therefore they are as the ſquares of their ſides; whence, as .509282 is to 10.51462, ſo is the ſquare of the ſide of any *dodecahedron* to the ſuperficies thereof; and as .3637 is to 2.78516, ſo is the cube of the ſide of any *dodecahedron* to the ſolidity of it.

DUTY, in a *military ſenſe*, is the exerciſe of thoſe functions that belong to a ſoldier.

Regulations for doing DUTY. In all *duties*, whether with or without arms, the tour of *duty* begins with the eldeſt downwards. 1ſt. *Duties* of honour, as the king's guard, the queen's guard, the prince of Wales's guard, and the captain-general's, or field-marſhal's, commanding the army. 2. Detachments of the army and out-poſts. 3. General officers guards. 4. The ordinary guards, both in camp and garriſon. 5. The picquets. 6. General courts-martial. 7. All kinds of *duty* called fatigues without arms.

An officer who is upon *duty*, cannot be ordered for any other before that *duty* is finiſhed, except he be on the picquet, and then the tour of the picquet ſhall paſs him.

If any officer's tour of *duty* for the picquet, general court-martial, or *duty* of fatigue, happen when he is on *duty*, he ſhall not make good ſuch *duty* when he comes off.

Guards, or detachments, which have not marched off from the parade, are not to be reckoned as for a *duty* done; but, if they ſhould have marched from the parade, it ſtands for a *duty* done, though they ſhould be diſmiſſed immediately.

General courts-martial that have aſſembled, and the members ſworn in, ſhall be reckoned on *duty*, though they ſhould be diſmiſſed without trying any perſon.

E

* ENCYCLOPŒDIA, meant originally no more than a circle; but at preſent it comprehends the whole circle or compaſs of learning, which comprehends all liberal arts and ſciences.

* ENGAGEMENT, in a *military ſenſe*, implies a particular or general battle by land, or an action of hoſtility between detachments of infantry or cavalry. The combat uſually begins by a vigorous cannonade, accompanied with the whole efforts of the ſmall arms, and the attack of the horſe, ſword in hand.

The various exigencies of the combat call forth the ſkill and reſources of the general, to keep the line of battle as complete as poſſible, when it has been equally attacked; by ordering troops from the reſerve, to ſupply the place of others who have ſuffered greatly by the action. His vigilance is ever neceſſary to review the ſituation of the enemy from van to rear, every motion of whom he ſhould, if poſſible, anticipate and fruſtrate. He ſhould ſeize the favourable moments of occaſion, which are rapid in their progreſs, and never return. See BATTLE, in the firſt Alphabet.

EPAULETTES, as a *military ornament*, are worn by all officers of the royal regiment of artillery, infantry, and cavalry. Thoſe for the dragoon-guards, horſe and dragoons, to have a gold or ſilver embroidered or laced *epaulette*, with fringe on the left ſhoulder. Thoſe of the light dragoons to have one on each

each shoulder. The officers of grenadiers to wear an *epaulette* on each shoulder. Those of the battalion to wear one on the right shoulder only. They are to be either of embroidery or lace, with gold or silver fringe. Those of the royal regiment of artillery to be gold embroidery, with gold fringe on scarlet cloth, and worn on the right shoulder. The cloth of *epaulettes* for the private men to be of the colour of the facing, with a narrow yellow or white tape round it, and worsted fringe.

F

FACE *of a bastion*, the two sides reaching from the flanks to the salient angle. These in a siege are commonly the first undermined, because they extend most outwards, and are the least flanked; consequently the weakest.

FACE *prolonged*, } FACE *extended*, } is that part of the line of defence razant, which is terminated by the curtain and the angle of the shoulder; that is, it is strictly taken the line of defence razant, diminished by the face of the bastions.

FERDWIT, in *ancient military history*, a term formerly used to denote a freedom from serving upon any military expedition; or, according to some, the being quit of manslaughter committed in the army.

FIELD, or *field of battle*, denotes a place where a battle was fought.

FIELD-*fort*. See FORT.

FIELD-*works*. See WORKS.

Running-FIGHT, that in which the enemy is continually chaced.

FIRE, in the *art of war*, is the discharge of all sorts of fire-arms against the enemy. The fire of the infantry is by a regular discharge of their firelocks, by platoons, divisions, &c. that of the cavalry, with their fuzees and pistols; and that of a place besieged, from their artillery.

FIRE *of the curtain*, or *second flank*, is from that part of the curtain comprehended between the face of the bastion prolonged, and the angle of the flank; frequently called the line of defence fichant.

FIRE *razant*, is by firing the artillery and small arms in a line parallel with the horizon, or parallel with those parts of the works you are defending.

FORTIFICATION. See this word in the first Alphabet.

Approaches, are a kind of roads or passages sunk in the ground by the besiegers, whereby they approach the place under cover of the fire from the garrison.

Caponier, is a passage made in a dry ditch from one work to another: when they are made from the curtain of the body of the place to the opposite ravelin, or from the front of a horn or crown-work, they have a parapet on each side, of 7 feet high, sloping in a glacis on the outside to the bottom of the ditch: the width within is from 15 to 18 feet, with a banquette on each side: there is a brick wall to support the earth within, which only reaches within 1½ foot of the top, to prevent grazing shot from driving the splinters amongst the defendants.

Caponiers with two parapets may properly be called double; as there are some made with one parapet only, in dry ditches of the ravelin, and in that of its redout, towards the salient angles, and open towards the body of the place.

Caponiers made from the body of the place to the out-works, are sometimes arched over, with loop-holes to fire into the ditch. The single ones in the ditch of the ravelin and redout are likewise made with arches open towards the place; for by making them in this manner, the guns which defend the ditch before them, can no other way be dismounted than by mines.

* *Assault*, is a sudden and violent attack, made uncovered, on the part of the rampart where the breach has been made.

* *Attack*, is the manner and disposition made by an army or smaller body of men, to drive an enemy out of a fortified place, or out of any strong situation, or to gain a post, &c.

Attacks of a siege. See SIEGE.

False attacks. See SIEGE.

To attack in flank, at a siege, is to attack both sides of the bastion; but against troops, is to fire along their line.

Barbet. See BATTERY.

* *Body of the place*, in a *general sense*, means the

the buildings in a fortified town: yet the inclosure round them is frequently understood by it; for we say, to construct the body of the place, which means no more than to fortify or inclose the place with bastions and curtains, &c.

Breast-work. See Parapet.

* *Capital of a work*, is an imaginary line which divides that work into two equal parts.

* *Capital of a bastion*, a line drawn from the angle of the polygon to the point of the bastion, or from the point of the bastion to the centre of the gorge. These capitals are from 35 to 40 toises in length, from the point of the bastion to the place where the two demi-gorges meet.

* *Centre*, the middle point of any work. From the *centre* of a place are drawn the first lines to lay down the form of a *fortification*.

* *Centre of the bastion*, is that point where the two adjacent curtains produced intersect each other.

Citadel, is a kind of fort or small fortification, of 4, 5, or 6 sides; sometimes joined to towns, and sometimes to defend rivers or passes, &c. They are generally built on the most advantageous ground, when near a city, the better to command it, and commonly divided from it by an esplanade, or open place, the better to hinder the approach of an enemy.

Command, is when a hill or rising ground overlooks any of the works of a *fortification*, and is within reach of cannon shot; such a hill is said to command that work. See Command, in the first Alphabet.

* *Complement of the curtain*, is that part of the interior side which forms the demi-gorge.

* *Complement of the line of defence*, is the remainder of that line, after the angle of the flank is taken off.

* *Crowned horn-work*, is a *horn-work* with a *crown-work* before it. See Crown-work, in the first Alphabet.

* *Demi-gorge*, is half the gorge or entrance into the bastion, not taken directly from angle to angle, where the bastion joins to the curtain, but from the angle of the flank to the centre of the bastion, or rather the angle the two curtains would make were they protracted to meet in the bastion.

* *Descent into the ditch*, is by trenches or guts made by way of saps in the ground of the counterscarp, under the covert-way, and covered with madriers, or clays well loaded with earth, to secure them against fire. In ditches that are full of water, the descent is made even to the superficies of the water; and then the ditch is filled with faggots, fast bound, and covered with earth. In dry ditches the *descent* is carried down to the bottom; after which traverses are made, either as lodgements for the troops, or to cover the miner.

Draw-bridge. See Bridge, in the first Alphabet.

Enfilade. A work is said to be enfiladed, when the artillery can fire into it, so that the shot can fly along the inside of the parapet.

* *Envelope*, is a work of earth raised sometimes in the ditch, sometimes like a plain parapet, and sometimes like a small rampart with a parapet to it. They are generally made before weak places.

Epaule, or the shoulder of the bastion, the angle made by the union of the face and flank.

* *Escarp*, is, properly speaking, any thing high and steep, and is used in *fortification* to express the outside of the rampart of any work next to the ditch.

* *Face prolonged*, that part of the line of defence razant, which is terminated by the curtain, and the angle of the shoulder.

Gorge of a flat bastion, is a right line, which terminates the distance between two flanks.

Gorge of a half-moon, the distance between the two flanks, taken on the right of the counterscarp.

Gorge of a ravelin, is the distrnce between the two sides or faces towards the place.

Gorges of all other out-works, are the entry into them from the place, the distance between their sides.

Gallery, is a passage made under ground, leading to the mines: they are from 4½ to 5 feet high, and about 3½ or 4 feet broad; supported at top by wooden frames, with boards over them.

* *Head of a work*, its front next the enemy, and farthest from the place.

Insult. A work is said to be *insulted*, when it is attacked suddenly and openly.

* *Interior side of a fortification*, an imaginary line drawn from the centre of one bastion to that of the next, or rather the curtain produced 'till they meet.

* *Place*, is commonly used in *fortification* instead of a fortified town.

Regular place, one whose angles, sides, bastions, and other parts are equal, &c.

Irregular place, one whose sides and angles are unequal, &c.

Salient angle, is that whose point turns from the centre of the place outwards.

* *Sconce*, a small field fort, built for the defence of some pass. See *Fort*.

Swallow's tail, a kind of out-work, only differing from a single tenaille, in that its sides are not parallel as those of the tenaille, but narrower towards the town than towards the country.

* *Terre plein of the rampart*, the horizontal superficies of the rampart, between the interior talus and the banquette. It is on the *terre plein* that the garrison pass and re-pass; it is also the passage of the rounds.

* *Wicket*, a small door in the gate of a fortified place, at which a man on foot may go in, and which may be opened though the gate is ordered to be kept shut.

Works. All the fortifications about a place are called the *works* of a place.

Out-works. All detached *works* in a *fortification* are so called.

Field FORTIFICATION, is the art of constructing all kinds of temporary works in the field, such as redouts, field-forts, star-forts, triangular and square forts, heads of bridges, and sundry sorts of lines, &c. An army intrenched or fortified in the field produces, in many respects, the same effect as a fortress; for it covers a country, supplies the want of numbers, stops a superior enemy, or at least obliges him to engage at a disadvantage.

The knowledge of a field-engineer being founded on the principles of *fortification*, it must be allowed, that the art of fortifying is as necessary to an army in the field, as in fortified places; and though the maxims are nearly the same in both, yet the manner of applying and executing them with judgement, is very different.

A project of *fortification* is commonly the result of a long meditation; but in the field it is quite otherwise: no regard is to be had to the solidity of the works; every thing must be determinnd on the spot; the works are to be traced out directly, and regulated by the time and number of workmen, depending on no other materials than what are at hand, or no other tools than the spade, shovel, pick-axe, and hatchet. It is therefore in the field, more than any where else, that an engineer should be ready, and know how to seize all advantages at first sight, to be fertile in expedients, inexhaustible in inventions, and indefatigably active.

Names of all the works used in field FORTIFICATION.

Bridge-heads, in *field fortification*, are made of various figures and sizes, sometimes like a redan or ravelin, with or without flanks, sometimes like a horn or crown-work, according to the situation of the ground, or to the importance of its defence. Their construction depends on various circumstances; for, should the river be so narrow, that the work may be flanked from the other side, a single redan is sufficient; but when the river is so broad, that the salient angle cannot be well defended cross the river, flanks must be added to the redan; but should a river be 100 toises or more across, half a square may be made, whose diagonal is the river side; and where a river is from 3 to 500 toises broad, a horn or crown-work should be made. All the different sorts of *heads of bridges*, are to be esteemed as good works against a sudden onset only, and their use almost momentary, as they sometimes serve but for a few days only, and at most during a campaign.

Forts, in *field-fortification*, are of various sorts, viz.

Field-forts, may be divided into two kinds; the one defending itself on all sides, as being entirely surrounded; the other, bordering on a river, &c. remain open at the gorge. They have the advantage of redouts, in being flanked, and the disadvantage in containing less within, in proportion to their extent.

Star-forts, are so called, because they resemble that figure. They are commonly made of 4 angles, sometimes of 5, and very rarely of 6; but we find them now made of 7 and 8 angles: but, let their figure be what they will, their angles should be equal; and, can they be formed of equilateral triangles, so much the better; for then the flanking angle being 120°, the fires cross better and nearer; and as the 2 flanks are on the same line, the space, not defended before the salient angle, is reduced to a parallelogram, whose smallest side is equal to the gorge.

Bastioned forts, differ in nothing from that of places, except that the figure be less, and the attack supposed of another kind. It is reckoned sufficient to flank them with half-bastions.

Triangular forts. As these kinds of *forts* contain less in proportion than any other, they are consequently to be used as seldom as possible.

Square forts, are in many respects preferable to the triangular ones. See FORT, in the first Alphabet.

Dams, are generally made of earth, but sometimes of other materials, as occasion may require: their use is to confine water.

Flèche,

Flèche, a work consisting in two faces, terminating in a salient angle of 90°. the faces are generally 75 or 80 feet long, the parapet 6 feet thick, and the ditch 7 feet broad.

Lines, in *field fortification*, are of several sorts, viz. the front of a fortification, or any other field-work, with regard to the defence, is a collection of lines, contrived so as reciprocally to flank each other.

Lines of intrenchment, are made to cover an army, or a place indifferently fortified, and which sometimes contains the principal magazine of an army; or to cover a considerable extent of ground, to prevent an enemy from entering into the country to raise contributions, &c.

Lines, let their form or shape be what they will, should be every where equally strong, and every where guarded alike.

Maxims. 1st. To inclose with the work as much ground as possible, having regard to circumstances. This attention chiefly concerns redouts and small works.

2d. If there are several works near each other, their lines of defence should be so directed, as to defend each other, without annoying themselves by their own fire.

3d. Not to depend on the defence of small arms, but where they can fire at right angles; as they generally fire without aim, and directly before them.

4th. Not to have recourse to the 2d flank or fire of the curtain, but when there is an absolute necessity.

5th. That the flanking angle be always a right one, or more obtuse, but never to exceed 100°, if possible, as there is no fear here, as in a fortification, of the flank being too much exposed. Besides, it is not necessary to graze the faces, or even to fire obliquely on them; since there is no danger of being exposed to the defence of a breach, or lodgement of the miners. The only thing to apprehend, is a sudden attack.

6th. That the flanking parts be sufficiently extended, so that the interior of their parapets at least rake the whole breadth of the opposite ditch.

7th. Never to make an advanced ditch in dry ground, unless it can be enfiladed throughout, and under a proper angle to be defended by the work which it covers or surrounds.

8th. Not to allow more than from 60 to 80 toises for the lines of defence, when they proceed from two flanks separated by two branches, forming a salient angle, or when not made to cross, though produced.

9th. That the parts most extended, and consequently the weakest in themselves, be as much defended as possible, and have at least the fire of two flanks, besides their own direct fire.

Redans, are a sort of indented works, consisting of lines or faces, that form salient and re-entering angles, flanking one another. Lines are often constructed with redans: their salient angles are generally from 50 to 70°.

Indented redans, are when the two faces are indented (see Pl. XV. *fig.* 2.) in that case the faces of each indented angle is 8½ feet only.

Tambour, a kind of work formed of pallisades, 10 feet long, and 6 inches thick, planted close together, and driven 2 or 3 feet into the ground; so that when finished it has the appearance of a square redout cut in two. Loop-holes are made 6 feet from the ground, and 3 feet asunder, for the soldiers to fire through, who are placed on scaffolds 2 feet high. They have often been used by the French with great advantage.

Têtes-de-pont. See *Bridge-heads.*

Trous-de-loup, are holes dug in the ground, circular at top, about 4½ feet diameter, and 6 feet deep, pointed at bottom, like an inverted cone, or sugar-loaf. A stake 6 feet long is fixed in their centre, driven 2 feet into the ground, and made sharp at top. Two or three rows of them are dug chequer-wise, about 6 paces from the ditch of a field-work. They prevent the approach of horse, &c.

* FLOOR, a measure formerly used by our engineers, and in some parts of England at present. Its dimensions are as follow: a measuring rod of 9 feet, two of which are called a perch or pole; that number squared; that is, 18 feet each way at right angles, and 1 foot deep, i. e. 324 solid feet of earth is called a *floor*.

* FRONTLET, or *aim frontlet*, is a piece of plank 3 inches thick, 1 foot long, and 7 or 8 inches high, with a round cavity underneath, to fit the outside of the gun, with a slit to see the object through it. It is placed on the vent-field, to direct the gunners in pointing.

G

GAUGES, in *gunnery*, are brass rings, with handles, to find the diameter of all kinds of shot with expedition.

GORGE. See FORTIFICATION.

GRAVITY, in *mechanics*, the natural tendency which all bodies have towards a centre.

Absolute GRAVITY, is the whole force with which a body tends downwards, or towards the centre of the earth, and is always equal to the quantity of matter the body contains, without any regard to its bulk, so that the *absolute gravity* of a pound of wood is equal to that of a pound of iron.

Relative GRAVITY, } is the excess of *gravity*
Specific GRAVITY, } of one body above that of another of equal dimensions, and is always proportionable to the quantity of matter under that dimension. Thus a cubic inch of lead is heavier than a cubic inch of wood; for the lead, being more dense than the wood, contains a greater quantity of matter under the same bulk. See GUNNERY.

**To give* GROUND, in a *military sense*, is to retire, to abandon or lose the post a body of men has been in.

GUNNERY, is that military art which teaches us to determine the course and to direct the motion of bodies shot from artillery, or other warlike engines. The great importance of this art, is the reason that we distinguish it from the doctrine of projectiles in general; for in truth it is no more than an application of those laws which all bodies observe when cast into the air, to such as are put in motion by the explosion of guns, or other engines of that sort: and it differs not whether we talk of projectiles in general, or of such only as belong to *gunnery*; for, from the moment the force is impressed, all distinction, with regard to the power which put the body first in motion, is lost, and it can only be considered as a simple projectile.

Every body cast into the air, moves under the influence of two distinct forces. By the one it is carried forward with an equal motion, and describes equal spaces in equal times, in the direction in which it was projected; and by the other, which we call *gravity*, is drawn downwards in lines perpendicular to the surface of the earth, with a motion continually accelerated, or whose velocity is always increasing. If either of these forces were destroyed, the body would move according to the direction of the other alone, so far as its motion was not hindered by the interposition of other bodies; but as both continue to act, the course of the projectile must be determined by a power compounded of those two forces.

Definitions of GUNNERY.

1. The *impetus* at any point of the curve is the perpendicular height to which a projectile could ascend, by the force it has at that point; or the perpendicular height from which a body must fall to acquire the velocity it has at that point.

2. The *diameter* to any point of the curve is a line drawn through that point perpendicularly to the horizon. Thus *A X*, *a x*, are *diameters* to the point *A*, *a*, Pl. XVI. *fig.* 10.

3. The points *A*, *a*, where the diameters cut the curve, are called *vertexes* to these diameters.

4. The *axis* is that diameter which cuts the curve in its highest or principal vertex, and is perpendicular to the tangent at that point or vertex. Thus *a x* is the *axis* of the curve *A C*, and is perpendicular to the tangent *a t*.

5. The *ordinates* to any diameter are lines drawn parallel to the tangent at the point where that diameter cuts the curve, and intercepted between the diameter and curve. Thus *D a* is an *ordinate* to the diameter *A X*, and *d C* is an *ordinate* to the axis *a x*, which is always at right angles with it.

6. The *absciss* is that part of the diameter which is intercepted between the ordinate and the curve. Thus *A D* is an *absciss* of the diameter *A X*, and *a d* one of the diameter *a x*.

7. The *altitude* of the curve is the perpendicular height of the principal vertex above the horizon. Thus *a d* is the *altitude* of the curve *A a C*.

8. The *amplitude*, *random*, or *range*, is the distance between the point of projection and the object aimed at. Thus *A C* is the *amplitude*, &c. of the curve *A a C*.

9. The *elevation* of the piece, is the angle its axis (produced) makes with the horizon, and the axis itself is called the direction.

10. The *horizontal distance*, to which a mortar, elevated to a given angle, and loaded with a given quantity of powder, throws a shell of a given weight, is called the range of that mortar, with that charge and elevation.

11. The *inclination of a plane*, is the angle it makes with the horizon, either above or below.

12. The

12. The *directrix* is a line passing through *M*, perpendicular to *A M*.

Laws of motion in GUNNERY.

1. Spaces equally run through with equal velocities, are to one another as the times in which they are run through, and conversely.

2. Spaces equally run through in the same or equal times, are to one another, as the velocities with which they are run through, and conversely.

3. Spaces run through are in the same proportion to one another, as their times multitiplied into their velocities, and conversely.

4. A body urged by two distinct forces in two different directions, will in any given time be found at the point where two lines meet that are drawn parallel to these directions, and though the points to which the body could have moved in the same time, had these forces acted separately.

5. The velocities of bodies, which by the action of gravity began to fall from rest, are in the same proportion as the times from the beginning of their falling.

6. The spaces run through by the descent of a body which began to fall from rest, are as the squares of the times, from the beginning of the fall.

7. The motion of a military projectile is in a curve.

Remarks on GUNNERY. As some who are entrusted with the management of artillery, are but too frequently found ignorant of the mathematical elements on which it is built, we shall endeavour to supply that defect in some measure by exhibiting two tables of proportions, which flow from the before-mentioned properties, which those who peruse the preceding laws of motion will perceive to flow from the properties there demonstrated; and those who do not, will be kind enough to take for granted.

The young artillerist will, I hope, by the help of these few proportions, be rendered more capable of performing what is usually required in *gunnery*, than he could by mere practice.

In order to hit any mark, find your distance from it; (the piece's impetus you are supposed to know) and then use this proportion.

Twice the impetus is to the amplitude, as radius is to the sine of double the angle of elevation. This angle is found practically by a quadrant and plummet, but best by a spirit-level and quadrant fixed on a ruler: but when the object is so near, that you can take aim with your eye, you need only dispart your piece.

The piece is supposed to be truly bored, its carriage-wheels of an equal height, the ground whereon these stand level, the trunnions equally high on the carriage, the gun placed exactly in the middle of the carriage, and at right angles with the axle-tree.

The gunner is also supposed to know the use of such instruments as are necessary for his purpose in the field; to have made frequent and exact trials of the gun's impetus, with a certain charge of the same powder; to have nicely proportioned that charge to the weight of the shot, and the execution he intends with it, at a given distance; and to have made such other observations as in the course of his practice he will find useful. These things being supposed, the two following tables will at one view give all the necessary cases for firing at objects on the plane of the horizon, with proportions for their solutions; as also those for firing on ascents and descents; and none I think can be proposed, that depend not immediately on, or may not be easily solved from them, in common practice.

Table I. For Horizontal Projections. *Fig.* 8 and 9. Pl. XVI.

Cases	Given	Required	Solutions.
1	$AM,\ Am$	tAH Hv	$2\,AM : Am :: R : S2 \angle tAH.$ $R : T \angle taH :: \frac{Am}{4} : Hv.$
2	$AM,\ tAH$	Am	$R : S2 \angle taH :: 2\,AM : Am.$
3	$Am,\ tAH$	AM	$S2 \angle tAH : R :: \frac{Am}{4} : AM.$
4	$AM,\ Hv$	Am	$\sqrt{AN \times NM} = \frac{AM}{4}$, or $\frac{1}{2}$ log. AN + $\frac{1}{2}$ log. NM + $\frac{1}{2}$ log. NM = log. $\frac{1}{4}$ Am.
5	$Am,\ Hv$	tAH AM	$\frac{AM}{4} : Hv :: R : T \angle taH.\ AN : \frac{Am}{4} :: \frac{Am}{4} : NM$, and $AN + NM = AM.$
6	$Hv,\ tAH$	Am	$T \angle tAH : R :: Hv : \frac{Am}{4}.$
7	$tAH,\ Am$ and any other angle. Any other amplitude.	Any other amplitude belonging to that angle. Any other angle belonging to that amplit.	$S2 \angle tAH$: $S2$ any other $\angle$ :: Am : amplitude required. Am : any other amplitude :: $S2 \angle taH$: $S2 \angle$ required.
8	$tAH,\ Hv$ any other angle. Any other altitude.	Any other altitude. Any other angle..	$V.\ S2 \angle tAH$: $V.\ S2$ any other $\angle$ :: Hv altitude required. Hv : any other altitude :: $V.\ S2 \angle tAH\ V.\ S2 \angle$ required.

The same stated numerically.

Case 1. The impetus $AM = 4000$, and amplitude $AM = 4200$ given, the direction tAH, and altitude vH required.

8000 : 4200 :: $R.\ S.\ 2 \angle \left\{\begin{matrix} 15^\circ & 50' \\ 74 & 10 \end{matrix}\right\}$ the $\left\{\begin{matrix}\text{lowest}\\ \text{highest}\end{matrix}\right\}$ direction.

Or to the log. of 4200 add radius, and from their sum subtract the log. of 8000, the remainder will be the logarithmic sine of $\left\{\begin{matrix} 31^\circ & 40' \\ 148 & 20 \end{matrix}\right\}$ half of which is $\left\{\begin{matrix} 15^\circ & 50' \\ 74 & 10 \end{matrix}\right\}$ for the $\left\{\begin{matrix}\text{lowest}\\ \text{highest}\end{matrix}\right\}$ direction.

R : tangent $\angle\ 15^\circ\ 50'$ :: 1050 : 298 the altitude.

Or to the logarithmic tangent of $15^\circ\ 50'$ add the log. of 1050, and from their sum subtract radius, the remainder will be the log. of 298, the altitude required.

Case 2. The impetus $AM = 3600$, and the direction $TAH = 75^\circ$ given, to find the amplitude AM.

$R.\ S2 \angle 75^\circ$ :: 7200 : 3600 amplitude AM.

Case 3. The amplitude $AM = 3000$, and direction $GAH = 45^\circ$ given, to find the impetus AM.

Sine $2 \angle 45^\circ : R$ :: 1500 : 1500 impetus AM.

Case 4.

Case 4. The impetus $AM = 2600$, and altitude $Hv = 1300$ given, to find the amplitude.

$AM - AN = NM = 1300$, and $\sqrt{AN \times NM} = 1300$, a fourth part of 5200 the amplitude.

Case 5. The amplitude $AM = 3140$, and altitude Hv $(AN) = 250$ given, to find the direction and impetus.

$785 : 250 :: R :$ tangent of $\left\{\begin{matrix} 17^\circ & 40' \\ 72 & 20 \end{matrix}\right\}$ the $\left\{\begin{matrix}\text{lower} \\ \text{higher}\end{matrix}\right\}$ direction. $250 : 785 :: 785 : 2465$, which, added to 250, give the impetus 2715.

Case 6. The altitude $Hv = 368$, and direction $tAH = 40^\circ\ 15'$ given, to find the amplitude.

Tang. $\angle\ 40^\circ\ 15' : R :: 368 : 435$, the 4th part of 1740 the amplitude.

Case 7. The direction $tAH = 28^\circ\ 12'$ with its amplitude $AM = 2550$, and any other direction $= 37^\circ\ 28'$ given, to find the amplitude for that direction.

Sine $\angle\ 56^\circ\ 24' : 2550 :: S\ \angle\ 74^\circ\ 56 : 2956$, the amplitude sought.

Case 8. The altitude $Hv = 180$, with its direction $tAH = 24^\circ\ 5'$ and any other altitude $= 400$ given, to find the direction for that other altitude.

$180 : 400 ::$ versed sine $48^\circ\ 10'$: versed sine $74^\circ\ 56'$, half of which is $37^\circ\ 28'$, the direction sought.

Table II. For Projectiles on Ascents and Descents. *Fig.* 6 and 7. Pl. XVI.			
Cases	Given	Required	Solutions.
1	AM, Am Bm, AB	TAH, tAH	$Am : Bm :: R : T.\ \angle\ BAm$, $\frac{1}{4}$ of which added to 45° gives $\angle\ GAz$. $AM : AB :: Ac : AC = CG.\ T.\ \angle\ GAz : R :: Gz : Az$ and $Az - Af = fz = PG$. $CG : PG :: R : V.\ S.$ of SG, $\frac{1}{2}$ of which added to, or taken from, GAz, gives the higher or lower direction required.
2	TAH, tAH AF.	AM	Log. of $AM =$ log. of $AF + 2$ log. $S.\ \angle\ MAF -$ log. $S\ \angle\ sAF -$ log. $S\ \angle\ MAs$.
3	TAH, tAH AM	AF	Log. of $AF =$ log. of $AM +$ log. $S\ \angle\ sAF +$ log. $S\ \angle\ MAs - 2$ log. $S\ \angle\ MAF$.
4	BAm tAH, AB, & any other angle tAH.	ab, the amplitude for that other angle.	Log. of $Af =$ log. of $AF +$ log. $S\ \angle\ pAf +$ log. $S < pAM -$ log. $S\ \angle\ sAF -$ log. $S\ \angle\ MAs$. *Fig.* 9.
5	AM, DAH	Ag.	$T\ \angle\ GAz$: sec. $\angle\ gAz :: Gz : Ag$. *Fig.* 6 and 7.

The same stated numerically.

Case 1. The horizontal distance $Am = 7000$, impetus $AM = 4200$, and the perpendicular height $Bm = 744$ given. to find the directions TAH, tAH.

$7000 : 744 :: R$: tangent $6^\circ\ 4'$, half of which added to 45° gives the angle $GAz = 48^\circ\ 2'$.

$7000 : 7040 :: 2100 : 2112$. Tangent $48^\circ\ 2' : R :: 2100 : 1887{,}5$. $2112 :: 137{,}5 :: R$: versed sine of $20^\circ\ 48'$, half of which added to, or subtracted from, $48^\circ\ 2$, gives $\left\{\begin{matrix} 58^\circ & 26' \\ 37 & 38 \end{matrix}\right\} = \left\{\begin{matrix} TAH \\ tAH \end{matrix}\right\}$ the $\left\{\begin{matrix}\text{higher} \\ \text{lower}\end{matrix}\right\}$ direction.

Case 2. The angles of direction $\left\{\begin{matrix} TAH = \\ tAH = \end{matrix}\right\}$

$\left.\begin{matrix}58^\circ & 26' \\ 37 & 38\end{matrix}\right\}$ and the amplitude $AB = 7040$ given, to find the impetus AM.

To the log. of $AF = 1760$ add twice the logarithmic fine of the angle $MAF = 83^\circ\ 56'$, and from their fum fubtract the logarithmic fines of the angles $sAF = 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, the remainder will give the log. of $2004 = AM$, the impetus required.

Cafe 3. The angles of the direction $\left\{\begin{matrix}TAH \\ tAH,\end{matrix}\right\}$ $= \left\{\begin{matrix}58^\circ & 26' \\ 37 & 38\end{matrix}\right\}$ and impetus $AM = 4200$ given, to find the length of the inclined plane AB, or the horizontal diftance Am, and perpendicular height Bm.

To the log. of $AM = 4200$, add the logarithmic fines of the angles $sAF + 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, and from their fum fubtract twice the logarithmic fine of the angle $MAF = 83^\circ\ 56'$, the remainder will give the log. of $1760 = AF$, a fourth part of $7040 = AB$, the inclined plane.

Cafe 4. The angle of obliquity $BAm = 6^\circ\ 4'$, any angle of direction $tAH = 37^\circ\ 38'$ and its amplitude $AB = 7040$, and any other angle of direction $tAH = 31^\circ\ 4'$ given, to find the amplitude Ab for that other angle.

To the log. of $AF = 1760$ add the logarithmic fines of the angles $pAf = 25^\circ$, and $pAM = 58^\circ\ 56'$, and from their fum fubtract the logarithmic fines of the angles $sAF = 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, the remainder will give the log. of $1537 = Af$ $\frac{1}{4}$ part of $6148 = Ab$ the amplitude. The converfe of this cafe is evident.

Cafe 5. The impetus $AM = 4200$, and angle of obliquity $DAH = 6^\circ\ 4'$ given, to find the greateft random on the plane AB.

Tangent $\angle\ 48^\circ\ 2'$: fec. $\angle\ 6^\circ\ 4'$ :: 2100 : 1899, a fourth part of 7596 the greateft range.

Scholium.

When the perpendicular height is given, and the horizontal diftance is required, the readieft and, we think, the beft way of finding it, is to obferve, with an inftrument, the angle which the object aimed at makes with the horizon, and to ufe this proportion.

As the tangent of that angle is to the perpendicular height given,

So is the radius to the horizontal diftance required.

But when the horizontal diftance is given, and the perpendicular height is required, fay,

As radius is to the horizontal diftance given,

So is the tangent of the angle found by obfervation, to the perpendicular height of the object required.

Example. Suppofing in the firft cafe Bm given $= 744$, and the angle BAm taken $6^\circ\ 4'$ fay, tangent $\angle\ 6^\circ\ 4'$: 744 :: R : 7000, the horizontal diftance.

And in the fecond cafe, fuppofing Am given $= 7000$, and the angle BAm taken $= 6^\circ\ 4'$, then fay,

R : 7000 :: tang. $= 6^\circ\ 4'$: 744, the perpendicular height.

Thus all the cafes of projections, as well on horizontal as on inclined planes, can be applied to numbers; and any mixed queftions which contain cafes both on horizontal and inclined planes, may be deduced from them almoft by infpection. For inftance:

1. Suppofe a piece of artillery planted at A (*fig.* 6) its angle of direction $tAH = 37^\circ\ 38'$, the horizontal diftance of the object $Am = 7000$, and its perpendicular height $Bm = 744$ given; to find that piece's amplitude on a horizontal plane, with the fame impetus at any given direction; or its direction on a horizontal plane with any other given amplitude.

By *cafe* 2, of afcents and defcents, find its impetus $= 4200$; then by *cafe* 2, of horizontals, find its amplitude $= 7274$, with the other given direction of 30° for example; or by *cafe* 1, of horizontals, find its direction equal to 30°, with the other given amplitude 7274.

2. The random and direction of a piece on the plane of the horizon being given, to find its random on an inclined plane of a given obliquity, and with a given direction.

Firft, find its impetus by *cafe* 2, of horizontals, and then its amplitude by *cafe* 3, of afcents and defcents.

3. Having the greateft range of a piece on a plane of a given inclination, to find its greateft amplitude on the horizon, fay,

As the fecant of the angle FAf is to the tangent of the angle GAz,

So is the fourth part of the greateft range on the inclined plane, to a fourth part of the greateft range on the horizon.

* HARBOURS,

H

*HARBOURS, in *military architecture*, a port or haven for shipping. The making and inclosing *harbours* with piers, so as to resist the winds and waves, for the preservation of ships in stormy weather, is one of the most useful and necessary works that can be made in a trading nation; since the security of their wealth and power depends greatly upon it. Hence it should be the particular study of every young engineer, who is desirous of being useful to his country, or of distinguishing himself, to make himself master of this branch of business: to which end, let me recommend *L'Architecture Hydraulique*, par M. Belidor; *Essai sur la Résistance des Fluides*, par M. d'Alembert, Maclaurin and Muller.

* HARQUEBUS, in *military history*, a kind of fire-arms, of the length of a musket, usually cocked with a wheel. It carries a shot of about 3 ounces. Not used at present.

HONOURS *of war*, in a *siege*, is when a governor has made a long and vigorous defence; is at last obliged to surrender the place to the enemy, for want of men and provisions; and makes it one of his principal articles, to march out with the *honours of war*; that is, with shouldered arms, drums beating, colours flying, and all their baggage, &c.

HOSTAGE, in the *art of war*, a person given up to an enemy, as a security for the performance of the articles of a treaty. When two enemies enter into a treaty or capitulation, it is common for them mutually to give hostages, as a security for their reciprocally performing the engagement they have entered into. An hostage becomes either an accessary, or principal, according to the state of things. Thus, for example, he is accessary, when a prince promises fidelity to another prince, and gives either his son, or some great lord, as a security for his performance, without any further capitulation; for then these *hostages* are only an additional engagement of the prince; and if he violates his word, they are not in any manner responsible. An *hostage* becomes a principal, when it is stipulated that he shall be answerable for the event of things. For instance, if a city promise to surrender within a certain time, in case it is not succoured, and, for the security of this article, give *hostages*; (which are in the same nature as bail given to a creditor to secure a debt:) so that, if the succour arrives in time, the promise becomes void, and the *hostages* are discharged; but if the succours do not arrive, and the city is guilty of a breach of faith, by refusing to surrender, then the *hostages* become principal, and may be punished for a breach of faith.

HOWITZER. See this word in the first Alphabet.

Dimensions of brass HOWITZERS, *as established by the Board of Ordnance in* 1764.

Brass howitzers	Nature	Length		Weight			Calibre of the howitz.	Diam. of the shell	Cham. con. pdr	
	Inche	F.	In.	C.	q.	lb.	In. hun.	In. hun.	lb.	oz
	8	3	1	11	0	0	8.0	7.75	3	8
	5.8	2	2	4	0	14	5.62	5.50	1	0
	4.5	1	10	2	0	14	4.52	4.40	0	8

N. B. The length is taken from the face of the muzzle to the back of the base ring, exclusive of the length of the cascable.

HOWITZ-*battery*, is made the same as a gun-battery, only the embrasures are made at least a foot wider, on account of the shortness of the *howitz*. See BATTERY.

K

*KIT, in *laboratory works*, a composition made of rosin 9lb. pitch 6lb. bees-wax 6lb. and tallow 1lb. used for the last covering of carcasses. When used, it must be broke into small pieces, and put into an iron pot, over the fire, and kept stirring about until it is all dissolved, and made very hot, which it must be whenever used; for it is then much better, and lies more equal, and closer on the carcass, than when it grows cold.

KITCHEN,

KITCHEN, in the *art of encamping*, is a ſpace of about 16 or 18 feet diameter; with a ditch ſurrounding it, 3 feet wide, the oppoſite bank of which ſerves as a ſeat for the men who dreſs the victuals. The *kitchens* of the flank companies are contiguous to the out-line of the camp, and the intermediate ſpace is generally diſtributed equally for the remaining *kitchens*; and as each tent forms a meſs, each *kitchen* muſt have as many fire-places as there are tents in the company.

L

LABORATORY. See that word in the firſt Alphabet.

Cartridges, are generally made of flannel, and filled with the following quantities of corned powder, both for land and ſea ſervice, viz.

Heavy	42-pound.	14lb.
	32 ——	10½
	24 ——	8
	18 ——	6½
	12 ——	5
	6 ——	3
	3 ——	1½
Medium	18-pdrs.	6½ lb.
	12 ——	4½
	6 ——	2½
	3 ——	1½
Light	24 ——	5
	12 ——	3
	6 ——	1½
	3 ——	12 oz.

Theſe *cartridges* are frequently fixed to round-ſhot, to caſe-ſhot, and to grape-ſhot, for the greater expedition in firing. See *Cartridges*, at the word LABORATORY, in the firſt Alphabet.

Flambeaux, a kind of lighted torch, uſed in the artillery upon a march, or the park, &c.

Formers, are cylinders of wood, of different ſizes and dimenſions, uſed in the *laboratory*, to drive the compoſition of fuzes and rockets.

Funnels, are of various ſorts, uſed to pour the powder into ſhells, and the compoſition into fuzes, and rocket-caſes.

Fuzes. See *Fuzes*, at the word LABORATORY, in the firſt Alphabet.

TABLE *of the different dimenſions of* Fuzes, *and time of burning*, &c.

Natures	Length of fuze	Diameter under the cap	Diameter at the end	Diameter of the cap inſide	Diameter of the cap outſide	Length of compoſition	Time of burning	Diameter of compoſition	Depth of the cap
Inches	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	Seconds	In. & 10.	In. & 10.
13	10.5	2.1	1.6	1.5	2.2	9.6	35 to 3	0.6	1.1
10	8.9	1.7	1.3	1.3	1.9	8.1½	30 to 35	0.4	0.9
8	8.1	1.5	1.1	1.1½	1.7½	7.2	29 to 31	0.3½	0.8
5½	5.6	1.2½	0.9	0.9	1.3	4.6	18 to 21	0.3	0.6
4⅖	4.7	1.1	0.7½	0.8½	1.1	4.0	15 to 17	0.3	0.5½
Hand-fuze	3.2	0.9	0.6½	0.6½	0.9	2.7	12 to 14	0.2	0.4
Muſ. mort.	3.1	0.7½	0.4½	0.5	0.7½	2.4½	10 to 12	0.1½	0.3½

How to drive Fuzes *into the ſhells*. When *fuzes* are to be drove, the lower end is cut off in a ſlope at the mark; ſo that the compoſition may give fire to the powder in the ſhell; and are to be of ſuch a length, that the ſhell may burſt as ſoon as it comes to the ground. The *fuze* is firſt put into the ſhell by the hand, and then drove with a mallet as far as it will go; taking care, however, not to ſplit it. As *fuzes* burn equal lengths, in equal times, great care muſt be taken, that thoſe of each nature be drove with the ſame mixture of compoſition, equally hard, in the ſame kind of weather, and, if poſſible, by the ſame perſon.

TABLE *of shells' ranges, in yards, at 45° elevation, by which* Fuzes *may be cut to any range required*

Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.
5	134	9¼	459	13½	977	17¾	1689	22	2595	26¼	3694
5¼	148	9½	484	13¾	1017	18	1737	22¼	2654	26½	3765
5½	162	9¾	509	·4	1050	18¼	1785	22½	1714	26¾	3856
5¾	177	10	536	14¼	1088	18½	1835	22¾	27[illegible]5	[illegible]7	3908
6	193	1[illegible]¼	563	14½	1127	18¾	1885	23	2836	27¼	3980
6¼	209	10½	591	14¾	1166	19	1935	23¼	2896	27½	4054
6½	226	10¾	619	15	1206	19¼	1986	23½	2961	[illegible]7¾	4128
6¾	244	11	649	15¼	1[illegible]46	19½	2[illegible]38	23¾	3024	28	4203
7	263	11¼	678	·5½	1288	19	2091	24	3088	28¼	4278
7¼	282	11½	70[illegible]	1[illegible]¾	1329	20	2144	24¼	31[illegible]3	28½	4354
[illegible]	301	11¾	739	16	1372	20¼	2[illegible]98	24½	3218	[illegible]8	44[illegible]1
7¾	322	12	772	16¼	1416	20½	2252	[illegible]4¾	3284	29	4509
8	343	12¼	804	16½	1459	2[illegible]	2308	25	3[illegible]5[illegible]	[illegible]9¼	4[illegible]87
8¼	365	[illegible]2½	834	16¾	15[illegible]4	21	2364	25¼	3418	29½	4665
[illegible]½	387	[illegible]2¾	871	17	1549	21¼	2420	2[illegible]½	34[illegible]6	29¾	4745
8¾	412	13	9[illegible]6	17¼	1595	2[illegible]	2478	[illegible]5¾	3555	30	48[illegible]5
9	434	13¼	94[illegible]	17½	1642	21¾	2536	26	3624	30¼	49[illegible]5

By this table, if you know the diſtance, you likewiſe know how many ſeconds the ſhell was in the air; and by knowing the time, you alſo know the diſtance; and may cut the *fuze* accordingly, by burning one or two, and making uſe of a ſtop-watch with a ſecond hand, or a pendulum that vibrates ſeconds. *Example.* Any number of ſeconds being given, required the range at an angle of 45° belonging to that time. *Rule.* Square the time of flight, and multiply that by $16\frac{1}{12}$, and the product divided by 3, the quotient gives the range in yards.

Example 1. How many yards in 12 ſeconds will the range be at 45 degrees elevation? viz.

$$\frac{12 \times 12 \times 16\frac{1}{12}}{3} = 772 \text{ yards; or } 12 \times 12 \times 193 = \frac{27792}{36} = 772 \text{ yards as before}$$

Example 2. The range of 45° being given, to know the ſeconds it was performed in, viz.

Rule. Multiply the range by 3, and divide the product by $16\frac{1}{12}$, the ſquare root of the quotient gives the number of ſeconds; or, to avoid fractions, multiply the range by 36 the 12ths contained in 3, and divide the product by 193, the 12ths contained in $16\frac{1}{12}$, the ſquare root of the quotient gives the ſeconds.

$$\sqrt{\frac{772 \times 3}{16\frac{1}{12}}} = \sqrt{\frac{2216}{16\frac{1}{12}}} = \sqrt{144} = 12 \text{ ſeconds;}$$

or $772 \times 3 \div 193 = \sqrt{2316 \div 193} = \sqrt{144} =$ 12 ſeconds, as before.

Hair-cloths, are uſed on the floor of powder magazines, and other places in the *laboratory*, where powder is uſed, to prevent accidents by fire, from men's ſhoes treading or rubbing any thing that may ſtrike fire.

Small ladles, are made of copper, with ſhort handles: they are uſed in filling the fuzes of ſhells, and caſes of ſky-rockets, &c.

Port-fires, are paper caſes of 17 inches long, and about ½ an inch in diameter; one of which will burn from 13 to 16 minutes. They are uſed in firing guns, mortars, and howitzers; or to light recreative fire-works. Their compoſition is ſalt-petre 6 lb. ſulphur 2 lb. and mealed powder 1 lb. mixed in the ſame manner as fuze compoſition. See *fuzes* and *port-fires*, at the word LABORATORY, in the firſt Alphabet.

Rockets, are of various ſorts, and for various purpoſes; but thoſe we ſhall here mention, are generally made uſe of for ſignals in the field.

Signal Rockets, } They are ſometimes made
Sky Rockets. } with reports, and ſometimes without. They are ſometimes made to be bounced; in this inſtance, their caſes muſt be made 1¾ or 2 diameters longer than the common proportion. *Signal-rockets* with reports are ſometimes fired in ſmall flights, or otherwiſe, to begin an attack, &c. Their compoſition is, ſalt-petre, 4 lb. ſulphur 1 lb. and charcoal 1 lb. 8 oz.

Setters, are round ſticks to drive fuzes, or any other compoſition made of paper.

Sheep-ſkins, are always uſed to cover the muzzles

zles of mortars and howitzers, between firing, to prevent any wet or dampnefs from getting into them.

Shot, are of various denominations, and for fundry ufes in the *art of war*.

Round-fhot, are all kinds of *fhot*, from a 42-pounder to an $\frac{1}{2}$ pounder.

Cafe-fhot, are fmall *fhot* put into cylindrical tin boxes, that juft fit the bores of thofe pieces of artillery they are intended to be fired out of. Their weight is from 6 oz. to $1\frac{1}{2}$ oz. and from 17 to 107 in one box. See *Cafe fhot*, at the word LABORATORY, in the firft Alphabet.

Grape-fhot, a certain number of fmall *fhot* of iron or lead, quilted together with canvais and ropes about a pin of iron or wood, fixed upon a bottom of the fame matter, fo as the whole together weigh nearly as much as the *fhot* of that calibre.

Length and weight of line for quilting fea-fervice Grape-fhot.

Pounders.	Line		Wt. for 100	
	Feet	Inch.	lb.	oz.
42	10	$1\frac{1}{4}$	14	8
32	9	$2\frac{1}{4}$	12	0
24	8	10	10	10
18	7	$4\frac{1}{2}$	5	12
12	6	$4\frac{3}{4}$	4	14
9	6	0	3	10
6	5	1	2	10
4	4	$7\frac{1}{4}$	1	3
3	4		0	12
$\frac{1}{2}$	2	$3\frac{1}{2}$	0	4

See *Grape-fhot*, at the word LABORATORY, in the firft Alphabet.

Squibs. Their compofition is, mealed powder 3 lb. charcoal 8 oz. falt-petre 3 oz. and fulphur 1 oz.

Tarpaulins, are made of ftrong canvas, thoroughly tarred, and cut into different fizes, according to their different ufes in the field; fuch as to cover the powder-waggons, tumbrels, and field-pieces, from rain.

M

*MAIL, or *coat of mail*, in *military antiquity*, a piece of defenfive armour for the body, generally made of fmall iron rings, interwoven in the manner of a net.

MENSURATION, in *military mathematics*, is the art and fcience which is concerned about the meafure of extenfion, or the magnitude of figures; and it is, next to arithmetic, a fubject of the greateft ufe and importance, both in affairs that are abfolutely neceffary in human life, and in every branch of the mathematics: a fubject by which fciences are eftablifhed, and commerce is conducted; by whofe aid we manage our bufinefs, and inform ourfelves of the

the wonderful operations in nature; by which we measure the heavens and the earth, estimate the capacities of all vessels and bulks of all bodies, gauge our liquors, build edifices, measure our lands and the works of artificers, buy and sell an infinite variety of things necessary in life, and are supplied with the means of making the calculations which are necessary for the construction of almost all machines.

It is evident that the close connection of this subject with the affairs of men would very early evince its importance to them; and accordingly the greatest among them have paid the utmost attention to it; and the chief and most essential discoveries in geometry in all ages, have been made in consequence of their efforts in this subject. Socrates thought that the prime use of geometry was to measure the ground, and indeed this business gave name to the subject; and most of the ancients seem to have had no other end besides *mensuration* in view in all their laboured geometrical disquisitions. Euclid's elements are almost entirely devoted to it; and although there be contained in them many properties of geometrical figures which may be applied to other purposes, and indeed of which the moderns have made the most material uses in various disquisitions of exceedingly different kinds, I say, notwithstanding this, yet Euclid himself seems to have adapted them entirely to this purpose: for, if it be considered that his elements contain a continued chain of reasoning, and of truths, of which the former are successively applied to the discovery of the latter, one proposition depending on another, and the succeding propositions still approximating towards some particular object near the end of each book; and when at the last we find that object to be the equality, proportion, or relation between the magnitudes of figures both plane and solid; it is scarcely possible to avoid allowing this to have been Euclid's grand object. And accordingly he determined the chief properties in the mensuration of rectilineal plane and solid figures; and squared all such planes, and cubed all such solids. The only curve figures which he attempted besides are the circle and sphere; and when he could not accurately determine their measures, he gave an excellent method of approximating to them, by shewing how in a circle to inscribe a regular polygon which should not touch another circle, concentric with the former, although their circumferences should be ever so near together; and, in like manner, between any two concentric spheres to describe a polyhedron which should not any where touch the inner one: and approximations to their measures are all that have hitherto been given. But although he could not square the circle, nor cube the sphere, he determined the proportion of one circle to another, and of one sphere to another, as well as the proportions of all rectilineal similar figures to one another.

Archimedes took up *mensuration* where Euclid left it, and carried it a great length. He was the first who squared a curvilineal space, unless Hypocrates must be excepted on account of his lunes. In his times the conic sections were admitted in geometry, and he applied himself closely to the measuring of them as well as other figures. Accordingly he determined the relations of spheres, spheroids, and conoids, to cylinders and cones; and the relations of parabolas to rectilineal planes whose quadratures had long before been determined by Euclid. He hath left us also his attempts upon the circle: he proved that a circle is equal to a right-angled triangle, whose base is equal to the circumference, and its altitude equal to the radius; and consequently that its area is found by drawing the radius into half the circumference; and so reduced the quadrature of the circle to the determination of the ratio of the diameter to the circumference; but which however hath not yet been done. Being disappointed of the exact quadrature of the circle, for want of the rectification of its circumference, which all his methods would not effect, he proceeded to assign an useful approximation to it: this he effected by the numerical calculation of the perimeters of the inscribed and circumscribed polygons; from which calculations it appears, that the perimeter of the circumscribed regular polygon of 192 sides is to the diameter, in a less ratio than that of $3\frac{1}{7}$ ($3\frac{10}{70}$) to 1, and that the inscribed polygon of 96 sides is to the diameter in a greater ratio than that of $3\frac{10}{71}$ to 1; and consequently much more that the circumference of the circle is to the diameter in a less ratio than that of $3\frac{1}{7}$ to 1, but greater than that of $3\frac{10}{71}$ to 1: the first ratio of $3\frac{1}{7}$ to 1, reduced to whole numbers, gives that of 22 to 7, for $3\frac{1}{7} : 1 :: 22 : 7$, which therefore will be nearly the ratio of the circumference to the diameter. From this ratio of the circumference to the diameter he computed the approximate area of the circle, and found it to be to the square of the diameter as 11 is to 14. He likewise determined the relation between the circle and ellipse, with that of their similar parts. The hyperbola too in all probability he attempted; but it is not to be hoped that he

met with any succefs, since approximations to its area are all that can be given by all the methods that have since been invented.

Besides these figures, he hath left us a treatise on the spiral described by a point moving uniformly along a right line, which at the same time moves with an uniform angular motion; and determined the proportion of its area to that of its circumscribed circle, as also the proportion of their sectors.

Throughout the whole works of this great man, which are chiefly on *mensuration*, he every where discovers the deepest design and the finest invention; and seems to have been (with Euclid) exceedingly careful of admitting into his demonstrations nothing but principles perfectly geometrical and unexceptionable: and although his most general method of demonstrating the relations of curved figures to straight ones, be by inscribing polygons in them, yet to determine those relations, he does not increase the number and diminish the magnitude of the sides of the polygon *in infinitum*; but from this plain fundamental principle, allowed in Euclid's elements, viz. that any quantity may be so often multiplied, or added to itself, as that the result shall exceed any proposed finite quantity of the same kind, he proves that to deny his figures to have the proposed relations, would involve an absurdity.

He demonstrated also many properties, particularly in the parabola, by means of certain numerical progressions, whose terms are similar to the inscribed figures; but without considering such series to be continued *in infinitum*, and then summing up the terms of such infinite series.

He had another very curious and singular contrivance for determining the measures of figures, in which he proceeds as it were mechanically by weighing them.

Several other eminent men among the ancients wrote on this subject, both before and after Euclid and Archimedes; but their attempts were usually upon particular parts of it, and according to methods not essentially different from theirs. Among these are to be reckoned Thales, Anaxagoras, Pythagoras, Bryson, Antiphon, Hypocrates of Chios, Plato, Apollonius, Philo, and Ptolomy; most of whom wrote of the quadrature of the circle, and those after Archimedes, by his method, usually extended the approximation to a greater degree of accuracy.

Many of the moderns have also prosecuted the same problem of the quadrature of the circle, after the same methods, to greater lengths: such are Vieta, and Metius, whose proportion between the diameter and circumference is that of 113 to 355, which is within about $\frac{3}{10000000}$ of the true ratio; but above all, Ludolph van Ceulen, who with an amazing degree of industry and patience, by the same methods extended the ratio to 20 places of figures, making it that of 1 to 3.1415926535 8979323846 +.

The first material deviation from the principles used by the ancients in geometrical demonstrations was made by Cavalerius: the sides of their inscribed and circumscribed figures they always supposed of a finite and assignable number and length; he introduced the doctrine of indivisibles, a method which was very general and extensive, and which with great ease and expedition served to measure and compare geometrical figures. Very little new matter however was added to geometry by this method, its facility being its chief advantage. But there was great danger in using it, and it soon led the way to infinitely small elements, and infinitesimals of endless orders; methods which were very useful in solving difficult problems, and in investigating or demonstrating theories that are general and extensive; but sometimes led their incautious followers into errors and mistakes, which occasioned disputes and animosities among them. There were now however many excellent things performed in this subject; not only many new things were effected concerning the old figures, but new curves were measured; and for many things which could not be exactly squared or cubed, general and infinite approximating series were assigned, of which the laws of their continuation were manifest, and of some of which the terms were independent on each other. Mr. Wallis, Mr. Huygens, and Mr. James Gregory, performed wonders; Huygens in particular must be admired for his solid, accurate, and very masterly works.

During the preceding state of things, several men, whose vanity seemed to have overcome their regard for truth, asserted that they had discovered the quadrature of the circle, and published their attempts in the form of strict geometrical demonstrations, with such assurance and ambiguity as staggered and misled many who could not so well judge for themselves, and perceive the fallacy of their principles and arguments. Among those were Longomontanus, and our countryman Hobbs, who obstinately refused all conviction of his errors.

The

The use of infinites was however disliked by several people, particularly by Sir Isaac Newton, who among his numerous and great discoveries hath given us that of the method of fluxions; a discovery of the greatest importance both in philosophy and mathematics; it being a method so general and extensive, as to include all investigations concerning magnitude, distance, motion, velocity, time, &c. with wonderful ease and brevity; a method established by its great author upon true and incontestible principles; principles perfectly consistent with those of the ancients, and which were free from the imperfections and absurdities attending some that had lately been introduced by the moderns: he rejected no quantities as infinitely small, nor supposed any parts of curves to coincide with right lines; but proposed it in such a form as admits of a strict geometrical demonstration. Upon the introduction of this method most sciences assumed a different appearance, and the most abstruse problems became easy and familiar to every one; things which before seemed to be insuperable, became easy examples or particular cases of theories still more general and extensive; rectifications, quadratures, cubatures, tangencies, cases *de maximis & minimis*, and many other subjects, became general problems, and delivered in the form of general theories which included all particular cases: thus, in quadratures, an expression would be investigated which defined the areas of all possible curves whatever, both known and unknown, and which, by proper substitutions, brought out the area for any particular case, either in finite terms, or in infinite series of which any term or any number of terms could be easily assigned; and the like in other things. And although no curve, whose quadrature was unsuccessfully attempted by the ancients, became by this method perfectly quadrable, there were assigned many general methods of approximating to their areas, of which in all probability the ancients had not the least idea or hope; and innumerable curves were squared which were utterly unknown to them.

The excellency of this method revived some hopes of squaring the circle, and its quadrature was attempted with eagerness. The quadrature of a space was now reduced to the finding of the fluent of a given fluxion; but this problem however was found to be incapable of a general solution in finite terms: the fluxion of every fluent was always assignable, but the reverse of this problem could be effected only in particular cases; among the exceptions, to the great grief of the geometers, was included the case of the circle, with regard to all the forms of fluxions attending it. Another method of obtaining the area was tried: of the quantity expressing the fluxion of any area, in general, could be assigned the fluent in the form of an infinite series, which series therefore defined all areas in general, and which, on substituting for particular cases, was often found to break off and terminate, and so afford an area in finite terms; but here again the case of the circle failed, its area still coming out an infinite series. All hopes of the quadrature of the circle being now at an end, the geometricians employed themselves in discovering and selecting the best forms of infinite series for determining its area, among which it is evident that those were to be preferred which were simple, and which would converge quickly; but it generally happened that these two properties were divided, the same series very rarely including them both: the mathematicians in most parts of Europe were now busy, and many series were assigned on all hands, some admired for their simplicity, and others for their rate of convergency; those which converged the quickest, and were at the same time simplest, which therefore were most useful in computing the area of the circle in numbers, were those in which, besides the radius, the tangent of some certain arc of the circle, was the quantity by whose powers the series converged; and from some of these series's the area hath been computed to a great extent of figures: Mr. Edmund Hally gave a remarkable one from the tangent of 30 degrees, which was rendered famous by the very industrious Mr. Abraham Sharp, who by means of it extended the area of the circle to 72 places of figures, as may be seen in Sherwin's book of logarithms; but even this was afterwards outdone by Mr. John Machin, who, by means described in Professor Hutton's *Mensuration*, composed a series so simple, and which converged so quickly, that by it, in a very little time, he extended the quadrature of the circle to 100 places of figures; from which it appears, that if the diameter be 1, the circumference will be 3.1415926535, 8979323846, 2643383279, 5028841971, 6939937510, 5820974944, 5923078164, 0628620899, 8628034825, 3421170679 +, and consequently the area will be 7853981633, 9744830961, 5660845819, 8757210492, 9234984377, 6455243736, 1480769541, 0157155224, 9657008706, 3355292669 +.

Pp 2

From

From hence it appears, that all or moft of the material improvements or inventions in the principles or method of treating of geometry, have been made efpecially for the improvement of this chief part of it, *menfuration*; which abundantly fhows, what I at firft undertook to declare, the dignity of this fubject; a fubject which, as Dr. Barrow fays, after mentioning fome other things, "deferves to be more curioufly weighed, becaufe from hence a name is impofed upon that mother and miftrefs of the reft of the mathematical fciences, which is employed about magnitudes, and which is wont to be called *Geometry* (a word taken from ancient ufe, becaufe it was firft applied only to meafuring the earth, and fixing the limits of poffeffions) though the name feemed very ridiculous to Plato, who fubftitutes in its place that more extenfive name of *Metrics* or *Menfuration*; and others after him give it the title of *Pantometry*, becaufe it teaches the method of meafuring all kinds of magnitudes." See SURVEYING, LEVELLING, and GEOMETRY.

MINING, in *military affairs*, is the art of blowing up any part of a fortification, building, &c. by gun-powder. The art of *mining* requires a perfect knowledge both of fortification and geometry; that by thefe previous helps, the engineer may be qualified to inform himfelf in the nature of all manner of heights, depths, breadths, and thickneffes; to judge perfectly of flopes and perpendiculars, whether they be fuch as are parallel to the horizon, or fuch as are vifual; together with the true levels of all kinds of earth. To which muft be added, a confummate fkill in the quality of rocks, earths, mafonry, and fands; the whole accompanied with a thorough knowledge of the ftrength of all forts of gunpowder.

Names of every thing ufed in MINING.

Auget, a kind of fmall trough, made of ftrong inch boards, about 4 inches fquare, in which the fauciffon is laid in ftraw, to prevent the powder from contracting any dampnefs.

Chamber, the place where the powder is lodged, being firft put in cubical boxes made for that purpofe.

Excavation, } the pit or hole made by a mine
Entonnoir, } when fprung.

Focus, the centre of the chambre where the powder is lodged.

Fougafs, a kind of fmall mine.

Fourneau. See *Chamber*.

Miners tools, are augers of feveral forts, levers of different forts, needles for working in rocks, rakes, fpades, fhovels, fledge-hammers, mafons hammers, pick-axes, picks, mattocks, chiffels, plummets, rules, a miner's dial, &c.

Line of leaft refiftance, is a line drawn from the centre of the fpace containing the powder, perpendicular to the neareft furface.

Gallery, the paffage leading to the powder.

Sauciffon, is a pipe or hofe made of coarfe cloth, whofe diameter is about an inch, and filled with gun-powder; then laid in the trough or auget, which extends from the chamber to the entrance of the gallery, that the miner who fets fire to it, may have time to retire before it reaches to the chamber. See *Mine*, in the firft Alphabet.

* MOINEAU, in *ancient irregular fortification*, a kind of flat baftion, raifed on the centre of the curtain in old fortifications, when the baftions were at too great a diftance from each other.

MORTARS. See this word in the firft Alphabet.

Dimenfions of all kinds of brafs MORTARS, *as eftablifhed by the Board of Ordnance, in* 1764.

	Nature	Length		Weight			Calibre of the mortar	Diameter of the fhell	Chamber contains powder	
	In.	F.	In.	C.	q.	lb.	In.hun.	In.hun.	lb.	oz
Brafs Mortars	13 S.	5	3	82	0	0	13.0	12.75	30	0
	10 S.	4	9	33	0	0	10.0	9.75	12	8
	13 L	3	8	25	0	0	13.0	12.75	10	0
	10 L.	2	9	11	0	0	10.0	9.75	3	12
	8 L	2	2	4	0	0	8.0	7.75	2	0
	5.8 R.	1	4	1	1	0	5.62	5.50	0	9
	4.5 C.	1	1½	0	3	0	4.52	4.40	0	5

N. B. The length is taken from the front or face of the muzzle, to the back of the bafe-ring, exclufive of the length of the cafcable. *S.* ftands for *fea-fervice mortar*, *L.* for *land-fervice mortar*, *R.* for *royal mortar*, and *C.* for *coeborn mortar*.

OFFICERS. See that word in the first Alphabet.

Marine OFFICERS, all those who command in that body of troops employed in the sea-service, under the direction of the lords of the admiralty.

* ORB, in *tactics*, is the disposing of a number of soldiers in circular form of defence. The *orb* has been thought of consequence enough to employ the attention of the famous marshal de Puysegur, in his *art of war*, who prefers this position, to throw a body of infantry in an open country, to resist cavalry, or even a superior force of infantry; because it is regular, and equally strong, and gives an enemy no reason to expect better success by attacking one place than another. Cæsar drew his whole army in this form, when he fought against Labienus. The whole army of the Gauls were formed into an *orb*, under the command of Sabinus and Cotta, when fighting against the Romans. The *orb* was generally formed 6 deep.

ORDERS, in a *military sense*, are of two sorts, viz.

General ORDERS, are such as are given out every day by the general who commands, who gives them in writing to the adjutant-general, who first sends exact copies to the general officers of the day, and distributes them at his own quarters to all the brigade majors, who daily go to head quarters for that purpose: there they write down every thing that is dictated to them; from thence they go and give the *orders*, at the place appointed for that purpose, to the different majors or adjutants of the regiments which compose that brigade, who first read them to their colonels and lieutenant-colonels, and then dictate them to a serjeant of each company (this is more frequently done by the serjeant-major) who write them correctly down in their respective orderly-books, and bring them to all the officers belonging to the company.

Regimental ORDERS, are such as regard the regiment only, the same as the *general orders* regard the whole army. These orders are given out by the commanding-officer of each regiment.

Orderly non-commissioned officers, are those who are orderly, or on duty for that week; who, on hearing the drum beat for orders, are to repair to the place appointed to receive them, and to take down in writing, in the orderly-book, what is dictated by the adjutant or serjeant-major; they are then immediately to show those orders to the officers of the company, and afterwards warn the men for duty.

ORDER *of the Bear*, a military order in Switzerland, erected by the emperor Frederic II. in 1213, by way of acknowledgment for the service the Swiss had done him, and in favour of the Abbey of St. Gal. To the collar of the order hung a medal, on which was represented a *bear*, raised on an eminence of earth.

P

PARADE, in a *military sense*, the place where troops assemble, before they go on duty.

General PARADE, in *garrison*, is that place where the troops assemble, after marching from their officers quarters, and regimental *parade*.

Regimental PARADE, in *garrison*, is that place where the troops of each company assemble for duty, before they march to the *general parade*.

PARADE, in *camp*, is that spot of ground in the front of each incampment, between the camp-colours on the right and left wings. See PARADE, in the first Alphabet.

* PARTUISAN. See SPANTON.

* PELATON. See PLATOON.

PIONEERS. See this word in the first Alphabet. Each *pioneer* to have an axe, a saw, and an apron; a cap with a leather crown, and a black bear-skin front, on which is to be the king's crest in white, on a red ground; also an axe and a saw. The number of the regiment to be on the back part of the cap.

PLACE, in a *military sense*, is a general name for all kinds of fortified towns, forts, or fortresses, where a party may defend themselves.

A regular PLACE, is one whose angles, sides, lines, bastions, and other parts, are equal; generally called, from the number of its angles, a pentagon, hexagon, &c.

Irregular PLACE, is one whose sides and angles are unequal. See PLACE, in the first Alphabet, &c.

PLASTER, in *building*, a substance made of water and some absorbent matter, such as chalk or lime, well pulverised, with which walls are overlaid. It differs from common lime, in that it composes a solid body by itself, without mixing either sand or any other ingredient, as is done in lime. The best sort is made of a bluish soft stone, taken out of quarries, much like the stone of which Dutch terrass is made. This stone is burnt in the same manner as lime, and, when cold, beat into a fine powder; and when used, about a bushel is put into a tub, and water poured in, 'till it becomes liquid; then well stirred, and used immediately.

* PLUGS, in *artillery*, are either wood or cork, to stop the fuze-holes of shells.

PONT. See BRIDGES, in the first Alphabet.

Têtes de PONT. See FIELD-FORTIFICATION.

* PRIMING, in *gunnery*, the train of powder that is laid, from the opening of the vent, along the gutter or channel, on the upper part of the breech of the gun, which, when fired, conveys the flame to the vent, by which it is further communicated to the charge, in order to fire the piece. This operation is only used on shipboard, at the proof, and sometimes in garrison; for, on all other occasions, tubes are used for that purpose.

* PRIMING-*wire*, in *gunnery*, a sort of iron needle, employed to penetrate the vent or touch-hole of a piece of ordnance, when it is loaded, in order to discover whether the powder contained therein is thoroughly dry, and fit for immediate service; as likewise to search the vent and penetrate the cartridge, when the guns are not loaded with loose powder.

PYROTECHNY, in the *art of war*, is the doctrine of artificial fire-works and fire-arms: teaching both the use and construction of those used in war; such as gunpowder, cannon, mortars, howitzers, shells, shot, grape, grenades, carcasses, mines, small-arms, and all kinds of military fire-works; with the art of founding guns, &c.

Q

QUARTER-*guard*. See GUARD, in the first Alphabet.

The *quarter-guard* is always commanded by a subaltern officer, and consists of about 20 or 30 men, whose duty it is to maintain good order in the camp. This guard now fronts outwards, though it was formerly the custom to front inwards, that is, to face the battalion; and as this guard is merely to maintain good order in the camp, the present alteration seems improper. The *quarter-guards* of all foreign troops front inwards. Those who wish to be well acquainted with guards, and encampments, will find satisfaction in Lochée's useful *Essay on Castrametation*.

R

* RAVES, in *artillery carriages*, are the upper wooden bars in a cart or waggon, supported by the round and flat staves which enter into them.

REAR-*guard*. See GUARD, in the first Alphabet.

REAR-*guard*, is always commanded by a non-commissioned officer, generally a corporal, and 6 or 8 men. This guard serves to keep good order in the rear of the camp, and has, 'till of late, fronted inwards; and the reason of its now fronting outwards is, in my humble opinion, improper.

REGIMENT *of artillery*. See ARTILLERY, in the first Alphabet.

* RHOMBUS, in *geometry*, an oblique-angled parallelogram, or a quadrilateral figure whose sides are equal and parallel, but the angles

gles unequal; two of the opposite ones being obtuse, and the other two acute.

* RHOMBOIDES, in *geometry*, a quadrilateral figure whose opposite sides and angles are equal, but is neither equilateral nor equiangular.

ROSE-*buds*. See NAILS, in the first Alphabet.

S

* SALLY-*ports*, in *fortification*, or *postern-gates*, as they are sometimes called, are those under-ground passages, which lead from the inner works to the outward ones; such as from the higher flank to the lower, or to the tenailles, or the communication from the middle of the curtain to the ravelin. When they are made for men to go through only, they are made with steps at the entrance, and going out. They are about 6 feet wide, and 8½ feet high. There is also a gutter or shore made under the *sally-ports*, which are in the middle of the curtains, for the water which runs down the streets to pass into the ditch; but this can only be done when there are wet ditches.

When *sally-ports* serve to carry guns through them for the out-works, instead of making them with steps, they must have a gradual slope, and be 8 feet wide.

SASHES, in *military dress*, are badges of distinction, worn by the officers of most nations, either round their waist, or over their shoulders. Those for the English army are made of crimson silk; for the Imperial army, crimson and gold; for the Prussian army, black silk and silver; the Hanoverians, yellow silk; the Portugueze, crimson silk with blue tassels.

SENTINELS. See this word in the first Alphabet.

All *sentinels* are to be vigilant on their posts; neither are they to sing, smoke tobacco, nor suffer any noise to be made near them. They are to have a watchful eye over the things committed to their charge. They are not to suffer any light to remain, or any fire to be made near their posts in the night-time; neither is any *sentry* to be relieved, or removed from his post, but by the corporal of the guard. They are not to suffer any one to touch or handle their arms, or in the night-time to come within 10 yards of their post.

No person is to strike or abuse a *sentry* on his post; but when he has committed a crime, he is to be relieved, and then punished according to the rules and articles of war.

A *sentinel*, on his post in the night, is to know nobody, but by the countersign: when challenges, and is answered, *Relief*, he calls out, *Stand, relief! advance, corporal!* upon which the corporal halts his men, and advances alone within a yard of the *sentry*'s firelock (first ordering his party to rest, on which the *sentry* does the same) and gives him the countersign, taking care that no one hear it.

* SEWER, in *military architecture*, a drain, conduit, or conveyance, for carrying off water foilage, &c. It is necessary that every building have conveniences for discharging its refuse water, and other useless and offensive matters: these are obtained by digging and laying *sewers* and drains at proper depths, and with the needful outlets: the great care is, that they be large enough; that they be placed deep enough, and have a proper descent; that they be well arched over, and have so free a passage, that there be no danger of their choaking up; the cleaning them being a work of trouble and expence.

Instead of making the bottom of the *sewer* a flat floor, let it be in form of an inverted arch, answering in part to the sweep of the arch above. Every one knows that the freest passage that can be, is through circular channels; and these would sufficiently wear that form; they would in a manner resemble so many vast water-pipes of a circular base, and there would be no danger of their filling up. The perpendicular walls would detain nothing, because there are no angles in their joining; and the bottom being round and free, all would run off easily as it should.

SHELLS. See this word in the first Alphabet.

To find the weight of a SHELL. *Rule*. Double the difference of the diameters of the *shell* and hollow sphere, and 7 times the result gives the weight in pounds, cutting off the two right-hand figures of whole numbers.

Example. Let the diameter of the shell be 13 inches, and that of the hollow sphere 9.5. Then the cube of 13 is 2197, and that of 9.5 is 857.375; the difference is 1339.625, its double is

is 2679.25, which multiplied by 7, gives 18754.625; and cutting off two places in whole numbers, the reſult is 187 lb. or 1 cwt. 2 qrs. 21 lb. the weight of the ſhell.

SHOT. See this word in the firſt Alphabet.

To find the weight of an iron SHOT, whoſe diameter is given; and the contrary. *Rule.* Double the cube of the diameter in inches, and multiply it by 7; ſo will the product (rejecting the 2 laſt or right-hand figures) be the weight in pounds.

Example. What is the weight of an iron *ſhot* of 7 inches diameter? The cube of 7 is 343, which doubled is 686, and this multiplied by 7 produces 4802, which, with the right-hand figures rejected, gives 48 pounds, the weight required.——N. B. This rule is ſufficiently exact for practical uſes.

To find the diameter of the SHOT, when the weight is given. *Rule.* Multiply the cube root of the weight in pounds by 1.923, and the product is the diameter in inches.

Example. What is the diameter of an iron *ſhot* of 52 pounds? The cube root of 52 is 3.732, which multiplied by 1.923 gives 7.177 inches, the diameter required.

Rule by logarithms.

To $\frac{1}{3}$ of the log. of 52 - -	0.572001
Add the conſtant log. - -	0.283979
And the ſum is the log. of the diameter 7.177 - - -	0.855980

To find the diameter of a SHOT, from the impreſſion or cavity it makes by ſtriking a braſs gun, or other object. *Rule.* Divide the ſquare of the radius of the cavity by the depth of it, and add the quotient to the depth; ſo will the ſum be the diameter of the *ſhot* required.

Example. A *ſhot* having ſtruck upon a braſs gun, made a cavity of 1.49 inches deep, and 4.94 inches diameter; what was the ſize of the *ſhot?* The radius of the cavity is 2.47, and its ſquare is 6.1009, which divided by the depth 1.49, the quotient is 4.1, to which adding 1.49, the ſum 5.59 inches is the diameter required, anſwering to a 24-pounder.

SIGNALS *by the drum*, made uſe of in exerciſe, inſtead of the word of command, viz.

SIGNALS by the drum.	*Operations.*
A ſhort roll, -	To caution.
A flam, - -	To perform any diſtinct thing.
To arms, -	To form the line or battalion
The march, -	To advance, except when intended for a ſalute.
The quick march, -	To advance quick.
The point of war, -	To march and charge.
The retreat, - -	To retreat.
Drum ceaſing, - -	To halt.
Two ſhort rolls, -	To perform the flank firing
The dragoon march,	To open the battalion.
The grenadier march,	To form the column.
The troop, - -	To double diviſions.
The long roll, - -	To form the ſquare.
The grenadier march,	To reduce the ſquare to the column.
The preparative, -	To make ready and fire.
The general, - -	To ceaſe firing.
Two long rolls,	To bring or lodge the colours.

SIGNS, in the *art of war,* certain *ſigns* by which the intention of the enemy may be diſcovered. The moſt infallible indication of the enemy's deſigns, previous to his taking the field, is the place where he depoſits his magazines.

When an army intends to march, it is a general cuſtom to cook their kettles on that day particularly. If therefore you perceive, at 5 or 6 o'clock in the morning, more ſmoke than ordinary in their camp, you are pretty certain they intend to move.

When an army intends to fight, it is a general cuſtom to call in all their large detachments of light troops; therefore, when you ſee this, you muſt be upon your guard.

If you have always the ſame general to contend with, you will in time be able, by repeated obſervations on his diſpoſition and manner of acting, to foreſee his deſigns.

* SLATE, in *military architecture,* a kind of bluiſh foſſile ſtone, very ſoft when dug out of the quarry, and therefore eaſily ſlit or ſawed into thin long ſquares, to ſerve inſtead of tiles for the covering of all kinds of military buildings, &c.

* SLUICES, in *military architecture,* are made for various purpoſes; ſuch as to make rivers navigable; to join one river to another, which is higher or lower, by means of a canal; to form inundations upon particular occaſions, or to drain ſpots of ground that are overflowed by high tides; they are alſo made in fortreſſes, to keep up the water in one part of the ditches, whilſt the other is dry; and to raiſe an inundation about the place when there is any apprehenſion of being attacked

SLUICES are made different ways, according to the uſes they are intended for: when they ſerve for navigation, they are ſhut with two gates preſenting an angle towards the ſtream;

when they are made near the sea, two pair of gates are made, the one pair to keep the water out, and the other in, as occasion may require: in this case, the gates towards the sea present an angle that way, and the others the contrary way. The space inclosed by these gates is called *chamber*.

When *sluices* are made in the ditches of a fortress to keep up the water in some parts, instead of gates, shutters are made, so as to slide up and down in gutters, or grooves; and when they are made to raise an inundation, they are then shut by means of square timbers let down into *cullises*, so as to lie close and firm. Particular care must be taken in the building of a *sluice*, to lay the foundation in the securest manner; that is, to lay the timber, grates, and floors, in such a form, that the weather cannot penetrate through any part, otherwise it will undermine the work, and blow it up, as it has sometimes happened: lastly, to make the gates of a proper strength in order to support the pressure of the water, and yet to use no more timber than what is necessary. Those who wish to be thoroughly acquainted with this kind of work, may meet with satisfaction in *L'Architecture Hydraulique, par M. Belidor*, or in Mr. Millar's *Practical Fortification*.

SURVEYING, in *military mathematics*, the art or act of measuring lands; that is, of taking the dimensions of any tract of ground, laying down the same in a map or drawing, and finding the content or area thereof.

Surveying, called also *geodæsia*, is a very ancient act; it is even held to have been the first or primitive part of geometry, and that which gave occasion to, and laid the foundation of all the rest.

Surveying consists of three parts: the first is, the taking of the necessary measures, and making the most necessary observations, on the ground itself; the second is, the laying down of these measures and observations on paper; and the third, the finding the area or quantity of the ground there laid down. The first is what we properly call *surveying*; the second we call *plotting*, *protracting*, or *mapping*; and the third, *casting up*.

The first, again, consists of two parts, viz. the making of observations for the angles, and the taking of measures for the distances. The former of these is performed by some one or other of the following instruments, viz. the theodolite, circumferentor, semi-circle, plain table, or compass. The latter is performed by means either of the chain, or perambulator.

The second branch of *surveying* is performed by means of the protractor, and plotting scale. The third, by reducing the several divisions, inclosures, &c. into triangles, squares, trapeziums, parallelograms, &c. but especially triangles; and finding the areas or contents of these several figures. See Love's *Geodæsia*, and Wyld's *Practical Surveyor*.

T

TABLE *of all the different dimensions for iron* TAMPIONS *used in sea-service grape shot.*

Natures	Bottom		Spindle	
Pounders	Diameter	Thickness	Height	Thickness
	Inches	Inches	Inches	Inches
42-pounder	6.6	0.6	9.3	0.7
32 ditto	6.0	0.6½	8.3	0.8
24 ditto	5.4	0.6	7.3	0.9
18 ditto	4.9	0.6½	6.5	0.7
12 ditto	4.3	0.5	5.5½	0.6
9 ditto	3.9	0.4½	5.4	0.4
6 ditto	3.4	0.4½	4.4	0.4
4 ditto	2.9	0.4	4.1	0.3
3 ditto	2.4	0.5	3.6	0.3
1½ ditto	2.1	0.3	3.2	0.2
½ ditto	1.4	0.2	2.0	0.1½

TABLE

TABLE *of experiments to find the best length of* GUNS, *and their* FITTEST CHARGES, *deduced from actual trials*, 1775.

	Heavy					Mediums					Light					Powder		Elevation		Range
Nature	Length		Weight			Length		Weight			Length		Weight							
Pdrs.	F.	In.	C.	q.	lb.	F.	In.	C.	q.	lb.	F.	In.	C.	q.	lb.	lb.	oz.	°	'	Yds.
42	9	6	61	2	10											21		6		2368
	10		62	1	18											14		6		2295
	10	6	62	2	25											14		6		2189
32	10		55	2	7											16		5	30	2043
	9	2	52	1	18											10	12	5		2103
	8		50	2	19											10	12	5	30	2118
24	11		51	0	5											12		5	30	2212
	9		39	1	3											8		5		2186
	9		39	1	3											8		5		2218
12	8		19	2	0											6		4	30	1780
	8		19	2	0											4		4		1637
	8		19	2	0											4		4		1652
24						8	5	40	2	0						12		5	30	1750
						8		40	1	0						8		5		1830
						8		40	1	0						8		5		1863
12											5	6	8	3	18	6		4	30	1203
											5		8	3	18	4		4		1189
											5		8	3	18	4		4		1216
6											4	6	4	3	14	3		5		1097
											4	6	4	3	14	2		5		1098
											4	6	4	3	14	2		5		1107
3											3	6	2	3	4	1	8	4	30	938
											3	6	2	3	4	1		4	30	943
											3	6	2	3	4	1		4	30	956

These experiments were the result of the mediums of 8 rounds to each; from whence it appears, that when the pieces were loaded with half the weight of the shot, the ranges were greater than when loaded with either more or less, except in the smaller calibres, where 1-3d seems to be the best charge. Again, the pieces of 9 feet long, carried farther than those of 10 feet 6 inches, and 11 feet, &c.

TABLE *of experiments with* GRAPE-SHOT *against a curtain* 39 *feet long, and* 8 *feet high, in* 1773.

Ordnance						Weight of				Greatest effect at 200 yards		Greatest effect at 300 yards	
Caliber	Length		Weight			Powder		Grape		Decimal parts of the char.	Weight of shot through	Decimal parts of the char.	Weight of shot through
	F.	in.	C.	q.	lb.	lb.	oz.	lb.	oz.				
H. 6-pound.	8	0	18	3	13	4	9	9	14	·31	3·4lb.	·33	3·3lb.
H. 6-pound.	8	0	18	3	13	3	2	5	8	·31	2.6	.22	1.2
H. 6-pound.	8	0	18	3	13	2	0	9	14	·33	2.7	.22	2.4
H. 6-pound.	8	0	18	3	13	2	0	5	8	·32	2.5	.29	1.6
L. 6-pound.	4	6	4	15	2	2	0	9	14	·34	3·4	.2	2.9
L. 6-pound.	4	6	4	15	2	1	8	5	8	·39	2.1	·38	2.0
L. 6-pound.	4	6	4	15	2	2	0	5	8	·38	2.6	·37	2.2
3-pounder	3	6	2	2	19	1	0	5	0	.42	2.0	·30	1·5
3-pounder	3	6	2	2	19	0	12	5	0	.62	1.8	.40	1.2
3-pounder	3	6	2	2	19	0	12	5	0	.58	1.6	.41	1.3
8-in. howit.	2	1½	11	3	0	3	0	38	4	·55	20.0	.27	10.0
8-in. howit.	2	1½	11	3	0	3	0	38	4	·57	18.7	.29	12.6
8-in. howit.	2	1½	11	3	0	3	0	38	4	·59	22 8	·36	11.8
5½-in. how.	1	6	4	0	0	1	0	13	8	.27	3·6	.22	3·0
5½-in. how.	1	6	4	0	0	1	0	13	8	.29	3 8	.23	3·5
5½-in. how.	1	6	4	0	0	1	0	13	8	·33	3·10	.22	3·7

In this table the 5 first columns are easily understood. By *greatest effect* is meant the effect of the best round in 4, which was fired each at ¼ a degree elevation, beginning at 0 degree, and that effect (or number through the curtain) is expressed in decimal parts of the whole charge of grape. Hence .33 in the last column but one, means .33 hundredth parts of 9 lb. 14 oz. = 3.3 lb. nearly, and so of the rest: so that, if such experiments were sufficiently pursued, these numbers would exhibit the comparative powers or fitness of each different kind of piece for grape-shot. N. B. *H.* means *heavy*, and *L.* *light* guns.

TABLE *of experiments with a light* brass 6-pounder, *with* case-shot; *length* 4 *feet* 7 *inches, weight* 5 c. 0 qr. 18 lb. *with* 72 *shot, being single proportion, and* 144, *double proportion in each case; weight of each shot* 1¼ *oz. against a target* 300, *and* 400 *yards distance. Weight of shot and bottoms* 6 *and* 12 lb.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target Through		Target Hit		Total thro' and hit	Mediums thro' and hit	Shot spread from centre to Right		Shot spread from centre to Left		N°. of shot in each case	Distance	Remarks
lb.	oz.	D.	M.	F.	In.	F.	In.	un.	ov.	un.	ov.	N°.	N°.	Yds.	F.	Yds.	F.	N°.	Yards	
1	4	1	0	3	3	2	9	4	1	27	5	37	37	17	2	15	1	72	300	Single proportion. Short bottoms.
1	4	1	0	3	3	3	7	1	0	29	9	39	37	14	2	31	2			
1	4	1	0	3	3.5	3	8	3	1	23	7	34	37	22	2	17	0			
1	12	1	0	3	3.7	6	0	4	3	24	5	36	33	17	2	20	0			
1	12	1	0	3	3	6	6	7	6	19	3	35	33	15	0	30	0			
1	12	1	0	3	3	6	4	6	4	12	6	28	33	12	1	18	0			
1	4	1	0	2	10.5	5	4	4	3	30	13	50	69	12	1	32	0	144	300	Double proportion. Short bottoms.
1	4	1	0	2	10.5	6	2	12	12	53	12	89	69	16	2	29	2			
1	4	1	0	2	10.5	5	10	8	3	50	9	70	69	20	0	30	2			
1	12	1	0	2	9.3	12	5	19	13	35	9	76	73	13	2	27	0			
1	12	1	0	2	9.3	9	9	14	14	35	14	67	73	16	1	29	1			
1	12	1	0	2	9.3	11	3	18	9	36	12	75	73	16	1	25	1			
1	4	1	30	3	3.5	4	8	5	2	17	10	34	31	11	1	31	1	72	400	Single proportion. Short bottoms.
1	4	1	30	3	3.5	3	9	3	0	16	6	25	31	12	1	26	0			
1	4	1	30	3	3.5	4	10	6	4	16	7	33	31	15	0	20	1			
1	12	1	30	3	2	5	11	7	0	20	6	33	24	11	0	31	1			
1	12	1	3	3	2.7	5	5	2	2	13	3	20	24	16	1	19	0			
1	12	1	30	3	2.7	6	3	1	0	11	6	18	24	23	1	29	0			
1	4	1	30	2	10.5	5	5	0	0	8	3	11	18	9	1	31	1	144	400	Double proportion. Short bottoms.
1	4	1	30	2	10.7	6	0	2	1	14	8	25	18	19	0	32	0			
1	4	1	30	2	10.3	5	6	1	0	12	5	18	18	13	1	32	0			
1	12	1	30	2	9.5	8	7.5	5	1	14	4	24	19	23	2	31	0			
1	12	1	30	2	9.3	10	6.5	0	0	15	6	21	19	12	1	31	1			
1	12	1	30	2	9.5	9	9.5	0	0	10	3	13	19	18	1	31	0			

Table *of experiments with a medium* brass 6-pounder, *with case-shot; length* 7 *feet* 2 *inches, weight* 10 c. 3qr. 0 lb. *with* 72, 144, *and* 216 *shot in each case, being single, double, and triple proportions, weight of each shot* 1¼ *oz. against a target* 300, *and* 400 *yards distance; weight and bottoms* 6, 12, *and* 18 *lb.* Woolwich, 1777.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target: Through		Target: Hit		Total through and hit	Mediums thro' and hit	Shot spread from centre to: Right		Left		Shot in each case	Distance	Remarks
lb.	oz.	D.	M.	F.	In.	F.	In.	under	over	under	over	N°.	N°.	yds.	F.	yds.	F.	N°.	yards	
2	8	1	0	5	8	8	6	23	3	10	3	30	36	18	0	10	0	72	300	Single proportion. Short bottoms.
				5	8	9	6	10	6	10	5	31	36	15	0	15	0			
				5	8	9	3	21	2	10	5	38	36	15	0	21	0			
3	8			5	5	15	4	19	10	3	6	38	33	23	0	30	0			
				5	5	17	0	18	4	7	0	29	33	15	1	17	0			
				5	5	17	10	21	4	5	2	32	33	8	0	28	0			
2	8	1	0	5	3	16	0	12	7	22	7	48	56	22	1	21	0	144	300	Double proportion. Short bottoms.
				5	3	18	0	21	3	23	10	57	56	15	0	25	0			
				5	3	18	0	21	8	22	10	61	56	23	2	22	0			
3	8			5	1	26	0	23	4	25	7	59	59	21		20	0			
				5	1	27	6	28	12	15	3	58	59	13	1	22	0			
				5	1	27	0	22	6	19	12	59	59	16	1	22	0			
2	8	1	0	4	10	24	0	28	8	31	10	77	75	24	0	30	0	216	300	Triple proportion. Short bottoms.
				4	10	21	6	17	10	33	11	71	75	26	1	19	0			
				4	10	21	6	23	10	28	12	73	75	21	1	22	0			
3	8			4	8	28	6	19	10	29	18	76	74	24	1	25	0			
				4	8	28	6	34	9	28	12	88	74	23	0	20	0			
				4	8	29	0	29	13	20	11	73	74	19	0	26	0			
2	8	1	30	5	8	7	6	2	1	22	9	34	37	18	1	28	0	72	400	Single proportion. Short bottoms.
				5	8	8	9	14	3	14	7	38	37	15	2	10	0			
				5	8	9	1	11	4	18	5	38	37	17	0	28	0			
3	8			5	5	12	8	8	5	12	1	26	28	21	1	13	0			
				5	5	12	7	13	6	15	3	37	28	13	0	23	0			
				5	5	12	3	6	7	6	3	22	28	23	0	30	2			
2	8	1	30	5	3	6	6	2	3	20	15	40	45	20	1	22	1	144	400	Double proportion. Short bottoms.
				5	3	6	8	4	5	26	19	46	45	26	1	21	1			
				5	3	6	7	6	3	27	11	47	45	21	1	21	0			
3	8			5	1	26	0	4	2	35	8	49	53	23	0	24	0			
				5	1	28	0	11	7	25	7	50	53	27	0	22	0			
				5	1	36	0	11	5	35	7	58	53	21	1	27	2			
2	8	1	30	4	8	12	7	12	4	36	6	59	66	25	1	20	0	216	400	Triple proportion. Short bottoms.
				4	8	12	7	3	1	47	16	67	66	20	0	31	2			
				4	8	13	6	14	3	43	14	74	66	23	1	22	0			
3	8			4	7	36	0	7	0	19	5	31	49	18	1	29	1			
				4	7	40	0	7	5	21	6	39	49	16	0	23	1			
				4	7	36	0	14	3	41	11	69	49	24	0	28	1			

TABLE *of experiments with a* heavy braſs 12-pounder, *with caſe-ſhot; length* 9 *feet; weight* 31 c. 1 qr. 16 lb. *with* 84 *ſhot in each caſe; weight of each ſhot* 2 *oz. againſt a target* 400 *yards diſtance. Weight of ſhot and bottom* 12 *lb.* 1778.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target: Through		Target: Hit		Target: Total through and hit	Target: Mediums thro' and hit	Shot ſpread from the centre to: Right		Shot ſpread from the centre to: Left		Shot in each caſe	Diſtance	Remarks
lb.	oz.	D.	M	F.	In.	F.	In.	under	over	under	over	No.	No.	yds.	F.	yds.	F.	No.	yard.	
6	0	2	0	6	9.6	4	6	11	8	4	2	25	25	24	0	24	1	84	400	Common bottoms.
				6	9.6	5	0	13	9	4	2	28	25	24	0	22	0			
				6	9.6	5	0	11	5	6	4	26	25	17	0	15	0			
				6	10.2	5	0	12	5	4	3	24	25	10	0	18	2			
				6	10.1	4	6	9	4	8	2	23	25	25	0	17	1			
				6	10.1	4	6	15	5	4	0	24	25	16	2	11	1			
		2	15	6	11	6	0	17	4	4	0	25	27	16	0	27	1	84	400	Short bottoms.
				6	11	5	0	13	6	9	0	28	27	17	2	9	0			
				6	10.6	5	6	22	5	3	2	32	27	17	2	19	1			
				6	11	5	0	17	1	8	3	29	27	13	1	20	1			
				6	10.5	5	6	16	2	5	0	23	27	24	2	7	0			
				6	11	5	6	11	8	4	1	24	27	12	2	14	2			
6	8	2	0	6	10	8	1	22	7	10	3	42	32	19	0	25	0	84	400	No bottoms.
				6	9	8	2	17	4	8	4	33	32	21	2	21	0			
				6	10	8	4	16	6	11	0	33	32	27	1	16	0			
				6	9	8	0	13	6	4	3	26	32	16	2	7	2			
				6	9	8	6	11	6	5	0	22	32	20	1	25	0			
				6	9	8	5	23	3	6	2	34	32	21	1	23	1			
		2	15	6	11	8	9	24	9	3	3	39	33	18	2	19	0	84	400	Common bottoms.
				6	9	8	7	17	9	4	2	32	33	21	0	26	2			
				6	10	8	4	11	14	3	0	28	33	22	1	14	2			
				6	10	8	8	17	8	4	2	31	33	23	1	11	1			
				6	10	8	3	17	9	4	3	33	33	23	2	14	1			
				6	11	8	4	16	5	5	3	29	33	20	1	12	1			
7	0	2	0	7	0	10	8	14	7	5	5	31	34	14	2	19	0	84	350	Short bottoms.
				7	1	11	0	13	11	7	1	32	34	22	2	19	2			
				7	0	10	8	16	5	2	0	23	34	3	1	12	0			
				7	0	10	8	20	14	3	4	41	34	28	0	19	0			
				7	1	11	3	17	8	7	2	34	34	24	1	19	1			
				7	1	11	2	20	8	10	2	40	34	20	0	21	1			
		2	30	6	9.4	11	3	13	7	6	0	26	27	8	0	25	0	84	550	No bottoms.
				6	10.5	11	3	16	2	3	1	22	27	24	0	17	0			
				6	9.5	11	5	14	10	1	0	25	27	24	2	17	0			
				6	9	11	4	14	13	2	1	30	27	12	1	16	0			
				6	9.5	11	4	17	6	6	1	30	27	20	2	12	1			
				6	9.7	11	5	16	10	1	2	29	27	16	0	19	0			

TABLE *containing the greatest ranges of the several* HOWITZERS, *with different charges and elevations, deduced from actual experiments.*

Elevation		CALIBRE 8 in. shell 42lb. chamb. holds 3lb. 8oz. shell 2¼lb. Greatest range 1800 yards.			ROYAL 5.8 shell 15lb. chamber holds 1lb. shell 14oz. Greatest range 1600 yards.			COEHORN 5.5 shell 8lb. cha. holds 8oz. shell 7oz. Greatest range 900 yards.			Time of flight.	Length of fuze.	Greatest range with the given charge.
Deg.	Min.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	seconds	inches	yards
7	30	0	4	12	0	2	4	0	1	8	1.46	0.18	120
8	0	0	5	8	0	2	7	0	1	11	1.49	0.21	128
8	30	0	6	4	0	2	10	0	1	14	1.62	0.30	136
9	0	0	7	0	0	2	13	0	2	0	1.78	0.32	150
9	30	0	7	12	0	3	0	0	2	4	1.83	0.46	180
10	0	0	8	8	0	3	4	0	2	7	2.10	0.70	216
10	30	0	9	4	0	3	8	0	2	10	2.79	0.72	248
11	0	0	10	0	0	3	12	0	2	13	3.10	0.89	306
12	0	0	10	12	0	4	0	0	3	0	3.19	0.98	343
13	0	0	11	8	0	4	4	0	3	6	3.68	1.08	382
14	0	0	12	4	0	4	8	0	3	12	4.10	1.22	418
15	0	0	13	0	0	4	12	0	4	0	4.75	1.26	480
8	0	0	13	12	0	5	0	0	4	8	3.04	0.88	210
9	0	0	14	8	0	5	4	0	5	0	3.19	0.94	328
10	0	0	15	4	0	5	9	0	5	8	3.58	0.93	360
11	0	1	0	0	0	5	13	0	6	0	3.74	1.04	389
12	0	1	4	0	0	6	1	0	6	8	4.60	1.18	467
13	0	1	8	0	0	6	7	0	7	0	5.12	1.46	648
14	0	1	12	0	0	6	12	0	7	8	6.54	1.49	792
15	0	2	0	0	0	7	1	0	8	0	7.12	2.48	900
8	0	2	4	0	0	7	10				7.10	3.33	962
10	0	2	8	0	0	8	0				.13	3.68	1136
12	0	2	12	0	0	10	0				9.21	3.80	1242
14	0	3	0	0	0	12	0				9.60	3.92	1308
15	0	3	4	0	1	0	0				10.10	4.32	1600
16	0	3	8	0							11.48	4.62	1800

This TABLE will be of great service to the young officer, who has not a collection of experiments, nor seen much practice.

TABLE *of practice, with the following brass ordnance.* Woolwich, 1777.

Ordnance: Nature	Length	Weight	Powder	Elevation	Recoil	Target's distance	Shot went to: Right	Left	Under	Over	Remarks
Pounders	F. In.	C. q. lb.	lb. oz.	D. M.	F. In.	yards	F. In.	F. In.	F. In.	F. In.	
Heavy 12	9 0	29 3 3	6 0	0 30	12 0	530	2 0			3 0	Through the target
				0 40	10 0		5 0		0 6		
				0 40	11 0			6 0		2 0	
				0 50	10 8		1 6		1 3		
Medium 12	6 6	21 1 11	4 8	0 30	9 0	400	2 0		7 0		
				1 0	11 6			8 0	8 0		
				1 0	9 0			5 0	2 0		Near the target
				0 30	11 3			6 3	0 8		
Light 6	4 6	5 0 26	1 8	0 15	13 0	300		0 6		3 0	
				0 0	15 0		0 6			0 6	
				0 15	19 0			1 6			
				0 30	16 7		1 4				Through the target
Heavy 12	9 0	29 3 3	6 0	0 30	8 0	530	6 0			2 0	
				0 30	10 0			9 0	4 6		
				0 35	9 4		7 0		6 0		
				0 35	8 7		3 4		3 5		Through the target
Medium 12	6 6	21 1 14	4 8	0 30	7 0	400	2 6			1 6	
				0 30	8 4		2 0			6 6	
				0 35	7 6		1 0		6 6		
				0 35	7 9						Through the target
Light 6	4 6	5 0 26	1 8	0 15	8 6	300	6 0			2 6	
				0 15	8 4		1 6			2 0	Through the target
				0 15	8 3		2 6		1 6		
				0 15	8 4		1 5		3 6		
Medium 12	6 6	21 1 14	4 8	0 15	12 0	400	7 0		3 0		
				0 15	13 6			1 0		2 6	Through the target
				0 15	13 0			2 6		1 4	
				0 15	13 6		3 6			3 8	
Light 6	4 6	5 0 26	1 8	0 30	14 0	300		0 6		0 6	
				0 30	13 0			4 0			Through the target
				0 15	13 0		4 0		4 0		
				0 15	13 6		3 6		3 0		
Heavy 12	9 0	29 3 3	6 0	1 0	10 0	400	2 0	6 0		4 0	
				1 0	10 6						Through the target
				1 0	10 6		4 0		2 6		Ditto
				1 0	10 4			1 0	2 6		Ditto

N. B. The first 12 rounds the shot were fixed to wooden bottoms; the second 12 rounds the shot were not fixed to wooden bottoms. All the rest had wooden bottoms.

TABLE, *containing the greatest ranges of the several* land mortars *with different charges, deduced from actual experiments.* 1773.

Calibre 13 inches, shell 205 lb. chamb. holds 8 lb. shell 9 lb. Greatest range 2500 yards.			Calibre 10 inches, shell 94 lb. chamb. holds 5¼ lb. shell 3¼ lb. Greatest range 3000 yards.			Calibre 8 inches, shell 42 lb. chamb. holds 2 lb. shell 2¼ lb. Greatest range 1800 yards.			Royal. Calibre 5⅗ inches, shell 15 lb. cha. 9 oz. shell 14 oz. Greatest range 1500 yards.			Coehorn. Calibre 4⅗ lb. shell 8 lb. cha. 4½ oz. shell 7 oz. Greatest range 900 yards.			Time of flight	Length of fuze.	Greatest range with the given charge	Square roots of the greatest range.
lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	Sec.	inch.	yds.	yards.
0	7	0	0	5	8	0	4	12	0	2	4	0	1	8	4.37	10.9	100	10
0	10	0	0	7	0	0	5	8	0	2	7	0	1	11	5.28	1.32	150	12.25
0	13	0	0	8	8	0	6	4	0	2	10	0	1	14	6.20	1.55	200	14.14
1	0	0	0	10	0	0	7	0	0	2	13	0	2	1	6.80	1.70	250	15.81
1	3	0	0	11	7	0	7	12	0	3	0	0	2	4	7.50	1.88	300	17.32
1	6	0	0	12	14	0	8	8	0	3	4	0	2	7	8.12	2.03	350	18.71
1	9	0	0	14	5	0	9	4	0	3	8	0	2	10	9.68	2.15	400	20
1	12	0	0	15	12	0	10	0	0	3	12	0	2	13	10.12	2.28	450	21.21
1	14	8	1	1	3	0	10	12	0	4	0	0	3	0	10.60	2.42	500	22.36
2	1	0	1	2	10	0	11	8	0	4	4	0	3	3	11.00	2.53	550	23.45
2	3	8	1	4	1	0	12	4	0	4	8	0	3	6	11.40	2.65	600	24.5
2	6	0	1	5	8	0	13	0	0	4	12	0	3	9	11.84	2.75	650	25.5
2	8	8	1	6	15	0	13	12	0	5	0	0	3	12	12.20	2.85	700	26.46
2	10	10	1	8	6	0	14	8	0	5	4	0	3	15	12.64	2.96	750	27.29
2	12	12	1	9	13	0	15	4	0	5	9	0	4	2	13.00	3.05	800	28.29
2	14	14	1	11	4	1	0	0	0	5	13	0	4	5	13.32	3.16	850	29.16
3	0	0	1	12	11	1	0	12	0	6	1	0	4	8	13.72	3.25	900	30
3	2	2	1	14	2	1	1	8	0	6	7				14.00	3.33	950	30.82
3	6	0	1	15	9	1	2	4	0	6	12				14.40	3.43	1000	31.63
3	8	8	2	1	0	1	3	0	0	7	1				14.72	3.50	1050	32.40
3	11	0	2	2	7	1	3	12	0	7	6				15.00	3.60	1100	33.16
3	13	8	2	3	14	1	4	8	0	7	11				15.28	3.68	1150	33.92
4	0	0	2	5	5	1	5	4	0	8	0				15.60	3.75	1200	34.64
4	2	8	2	6	12	1	6	0	0	8	4				15.84	3.82	1250	35.35
4	5	0	2	8	1	1	6	12	0	8	9				16.12	3.90	1300	36
4	7	8	2	9	8	1	7	8	0	8	13				16.48	3.96	1350	36.74
4	10	0	2	10	15	1	8	4	0	9	0				16.72	4.03	1400	37 42
4	12	8	2	12	6	1	9	0							17.00	4.12	1450	38.08
4	15	0	2	13	13	1	9	12							17.28	4.18	1500	38.73
5	1	8	2	15	4	1	10	10							17.56	4.25	1550	39.37
5	4	0	3	0	11	1	11	8							17.80	[illegible]	1600	40
5	6	8	3	2	2	1	12	11							18.12	4.39	1650	40.62
5	9	0	3	3	9	1	13	10							18.48	4.45	1700	41.23
5	11	8	3	5	0	1	14	10							18.59	4.53	1750	41.83
5	14	0	3	6	7	2	0	0							18.72	4.62	1800	42.43
6	12	0	3	9	5										19.03	4.75	1900	43.59

Table *of the greatest ranges of* sea-mortars, *with different charges, deduced from actual experiments.*

13 inch. chamber holds 30lb.	Flight in seconds	Fuze in inches	Range in yards	10 inches. Chamber holds 12lb.	Flight in seconds	Fuze in inches	Range in yards
10	15	[illegible].18	3127	4	22½	4.83	2550
15	19½	5.83	3206	6	23	4.95	2650
20	25	6.25	3300	8	23½	5.75	2800
25	26½	6.74	3413	9	24¼	5.94	3000
28	27½	7.03	3796	10	25	6.13	3200
30	29	7.25	4000	11	25½	6.25	3350
30	29½	7.25	4013	12	26	6.44	3500

Though these two last *tables* of all the different kinds of mortar-practice, deduced from actual experiments, are not strictly to be depended on by the practitioner, who has time and opportunity to make a set of experiments with the very piece he is using, (for those are preferable to any others); nevertheless, these two *tables* will be of singular use to a young officer who enters on actual service, without having seen much practice.

TILE, TYLE, in *military building*, a sort of thin, factitious, luminated brick, used on the roofs of houses; or more properly a kind of clayey earth, kneaded and moulded of a just thickness, dried and burnt in a kiln, like a brick, and used in the covering and paving of different kinds of military and other buildings. The best of brick earth should only be made into *tiles*.

The *tiles* for all sorts of uses may now be comprised under 7 heads, viz. 1. The *plain tile*, for covering of houses, which is flat and thin. 2. The *plain tile*, for paving, which is also flat, but thicker; and its size 9, 10, or 12 inches. 3. The *pan-tile*, which is also used for covering of buildings, and is hollow, and crooked, or bent, somewhat in the manner of an S. 4. The *Dutch glazed pan-tile*. 5. The *English glazed pan-tile*. 6. The *gutter-tile*, which is made with a kind of wings. And 7. The *hip* or *corner-tile*.

Plain Tiles, are best when they are firmest, soundest, and strongest. Some are duskier, and others ruddier, in colour. The dusky-coloured are generally the strongest. These *tiles* are not laid in mortar, but pointed only in the inside.

Paving-Tiles, are made of a more sandy earth than the common or *plain-tiles*: the materials for these last must be absolute clay, but for the others a kind of loam is used. These are made thicker and larger than the common *roof-tiles*; and, when care has been taken in the choice of the earth, and the management of the fire, they are very regular and beautiful.

Pan-Tiles, when of the best kind, are made of an earth not much unlike that of the *paving tiles*, and often of the same; but the best sort of all is a pale-coloured loam that is less sandy; they have about the same degree of fire given them in the baking, and they come out nearly of the same colour. These *tiles* are laid in mortar, because the roof being very flat, and many of them warped in the burning, will not cover the building so well, as that no water can pass between them.

Dutch glazed Pan-Tiles, get the addition of glazing in the fire. Many kinds of earthy matter running into a glassy substance in great heat, is a great advantage to them, preserving them much longer than the common *pan-tiles*, so that they are very well worth the additional charge that attends the using of them.

English glazed Pan-Tiles, are in general not so good as the Dutch ones under that denomination; but the process is nearly the same.

Dutch Tiles, for chimnies, are of a kind very different from all the rest. They are made of a whitish earth, glazed and painted with various figures, such as birds, flowers, or landscapes, in blue or purple colour; and sometimes quite white: they are about 6.5 inches each way, and three quarters of an inch thick. They are at present grown into neglect.

Gutter-Tiles, are made of the same earth as the common *pan-tiles*, and only differ from them in shape; but it is advisable, that particular care be taken in tempering and working the earth for these, for none are more liable to accidents. The edges of these *tiles* are turned up at the larger ends for about 4 inches. They are seldom used where lead is to be had.

Hip or *Corner*-Tiles, are at first made flat like *pan-tiles* of a quadrangular figure, whose two sides are right lines, and the ends arches

of

of circles; the upper end concave, and the lower convex; the latter being about 7 times as broad as the other: they are about 10.5 inches long; but, before they are burnt, are bent upon a mould in the form of a *ridge-tile*, having a hole at the narrow end, to nail them on the hip-corner of the roof.

Ridge-TILES, are used to cover the ridges of houses, and are made in the form of a semi-cylindrical surface, about 13 inches in length, and of the same thickness as *plain-tiles*: their breadth at the outside measures about 16 inches.

W

WADDING. See this word in the first Alphabet.

Experiments relative to the effects of WADDING.

The quantity of powder requisite to raise a shell, weighing 218 lb. clear of the mortar and bed, was found to be 4 oz. 2 dr. without any *wadding*; but with the help of a little *wadding*, rammed over the powder, 3 oz. and 1 dr. was sufficient. The powder requisite to raise a shell weighing 106 lb. clear of the mortar and bed, was found to be 2 oz. 6 dr. without any *wadding*; but with *wadding*, properly rammed over the powder, 2 oz. was found to be sufficient.

To raise a shell of 16 lb. 4 dr. was sufficient without *wadding*, and only 3 dr. with *wadding*.

And to raise a shell of 8 lb. 2 dr. was enough without *wadding*, and $1\frac{2}{3}$ dr. with *wadding*.

From the above experiments it may be observed, that the judicious ramming a little *wadding* over the powder, adds about 1-4th part of the whole effect.

THE END.

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Clear the large of their fish without boiling, if possible; the small may be kept with their operculum, and fish in them, without offence, in bran, sand, &c. to dry.

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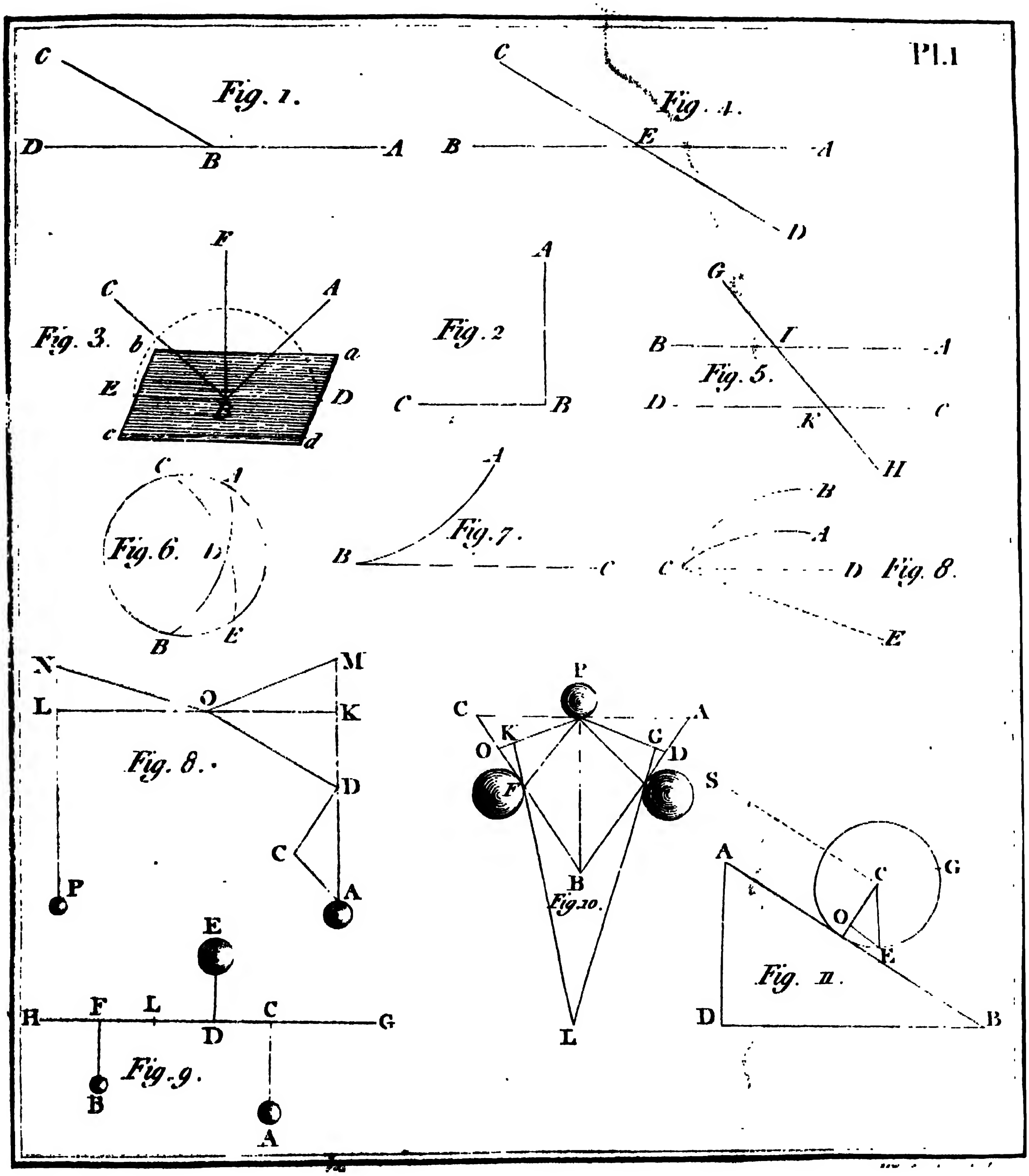
Pl. I
Fig. 1.
Fig. 2
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.